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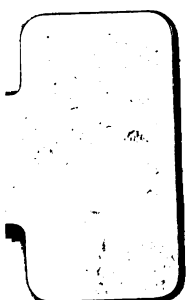

THE

MEDICAL REMEMBRANCER;

OR,

BOOK OF EMERGENCIES.

THE

MEDICAL REMEMBRANCER;

OR,

BOOK OF EMERGENCIES:

CONCISELY POINTING OUT

THE IMMEDIATE REMEDIES

TO BE ADOPTED IN THE

FIRST MOMENTS OF DANGER

FROM

POISONING, DROWNING, APOPLEXY, BURNS & OTHER ACCIDENTS;

WITH THE TESTS FOR THE PRINCIPAL POISONS, AND OTHER USEFUL INFORMATION.

By EDWARD B. L. SHAW, M.R.C.S. & L.A.S.

LATE ONE OF THE SURGEONS TO THE ROYAL HUMANE SOCIETY, AND LATE ASSISTANT-APOTHECARY TO ST. BARTHOLOMEW'S HOSPITAL.

BODLEIAN PUBLIC LIBRARY

THIRD EDITION.

"Docti discant et ament meminisse periti."

LONDON:

JOHN CHURCHILL, PRINCES STREET, SOHO.

MDCCCXLIX.

PREFACE.

THE want has been felt amongst the junior members of the Profession of some practical guide in cases of sudden emergency, which should be at once so portable as to admit of being conveniently carried in the pocket, and so concise as to present at a glance the most appropriate remedy for the case, unencumbered with other matters, which, however valuable in themselves, tend only, in the first moments of alarm and confusion, to distract the attention from the object of primary importance. The immediate steps to be pursued is all that is here endeavoured to be shown; and the time consumed in turning over a large volume in quest of them (supposing one to be at hand, which is frequently not the case,) induced the Author to compile the present Manual for the

use of his own Pupils. When it is considered how often the responsible charge of a Surgery or Chemist's Shop is committed to an inexperienced young man, who may, while thus employed, be called upon, at a moment's notice, to prescribe in a case of extreme danger, an attempt to point out the proper remedy, and thus prevent perhaps a fatal error, may not be deemed altogether useless. Upon this plea alone, it is submitted to the Profession and the Public, in the words of Ovid—

"Da veniam scriptis quorum non gloria nobis
Causa, sed utilitas officiumque fuit."

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THE

MEDICAL REMEMBRANCER.

CHAPTER I.

AN ALPHABETICAL CATALOGUE OF THE MOST COMMON POISONS, WITH THE IMMEDIATE TREATMENT TO BE ADOPTED IN CASE OF THEIR BEING TAKEN INTO THE SYSTEM.

ACIDS.

ACID, HYDROCYANIC OR PRUSSIC.

(Also Substances containing it, as the Essential Oil of Bitter Almonds, Cherry-laurel Water, Noyau, &c.)

IMMEDIATE TREATMENT.

THERE are four principal agents to be relied upon in the treatment of poisoning by this acid, viz. *chlorine*, *ammonia*, *cold affusion*, and *artificial respiration*.

Chlorine.—This is the most effectual chemical antidote, and should therefore be administered as speedily as possible; a tea-spoonful or two of *chlorine-water*

diluted being given, or, in the absence of this, 30 or 40 drops of the solution of *chloride of lime*, or of *chloride of soda*, in a little water. The patient should at the same time inhale air impregnated with *chlorine gas*, (especially during the performance of artificial respiration,) which may be abundantly evolved for the purpose, by adding a few drops of dilute hydrochloric acid to the solution of either of the above-mentioned chlorides. Clysters containing chlorine may also be advantageously employed.

Ammonia.—If the patient be able to swallow, this should be given in repeated doses, properly diluted; the most convenient forms of it being the *spirit of sal volatile*, or of *hartshorn* in water, which are generally at hand, or, if not, ten or twelve grains of the salt out of a common smelling-bottle may be substituted. But the more effectual mode of applying the remedy is by inhaling the vapour of it, which the patient should be made to do; using, however, proper caution and intermission, as in one or two cases recovery was precluded by the too assiduous, though well-intentioned, application of it to the nostrils, opposing the returning respiration.

Cold affusion.—This, being *always* and *immediately* applicable, may be considered the *best* remedy, and should be instantly employed; its efficacy has been fully established in animals poisoned by this agent. A stream of the coldest water that can be procured

should be poured from a pitcher on the head and spine for some minutes, and also dashed upon the face and chest. But this and the other means will be powerfully assisted by *artificial respiration*, which must never be omitted. It is easily accomplished by making strong pressure with both hands on the anterior surface of the chest, the diaphragm being at the same time pushed upwards by an assistant; while inspiration is effected by the mere removal of the pressure, and consequent resiliency of the ribs. This process should be repeated from fifteen to twenty-five times in a minute, so as to imitate natural breathing as nearly as possible.

Another powerful means of restoring sensibility and respiration is *electricity*, or—what is better—*electro-galvanism*. The best method of applying this is to place one wire at the nape of the neck, and the other at the pit of the stomach, so as to excite the diaphragm.

ACID, HYDROCHLORIC OR MURIATIC.

(Spirits of Salt, or of Sea Salt.)

Mix an ounce of calcined magnesia with a quart of water, and give a wine-glassful every five minutes. Soap, chalk, or whiting scraped off the wall, mixed with water, or milk, oil, white of egg, or demulcents of any kind, may be given till magnesia can be procured. Vomiting to be afterwards excited by tickling the throat with a feather or the finger.

ACID, NITRIC.—*(Aqua-fortis.)*

Treatment the same as for *Sulphuric Acid.*

ACID, OXALIC.—*(Acid of Sugar.)*

Also Salt of Wood-sorrel, or Essential Salt of Lemons.

Give as quickly as possible large quantities of chalk, whiting, or magnesia, mixed with water to the consistence of cream. In the absence of these antidotes, administer *copious draughts* of warm water, at the same time promoting vomiting by tickling the throat. The stomach-pump and emetics may be used; but, on account of the rapidity with which this poison acts, it is not advisable to lose time by their application, until after the antidote has been administered.*

ACID, SULPHURIC OR VITRIOLIC.

(Oil of Vitriol—Spirits of Vitriol—Vitriol.)

Dilute instantly and copiously with magnesia, chalk, or whiting, suspended in water. In the absence of these, soap-suds, water of wood-ashes, milk, oil, or in fact any mild diluent that first comes to hand,—not a moment being to be lost in waiting for the most appropriate *chemical* remedy. Nor should we be deterred from giving water alone, by the unimportant objection of the heat produced by its mixing with the acid in

* The use of the alkalies—potash, soda, or their carbonates—must in these cases be avoided, since the salts which they form with oxalic acid are as poisonous as the acid itself. —*Taylor, Medical Jurisprudence*, page 119.

the stomach. External parts burnt with vitriol should be washed with a solution of soap, or simple water.

ACID, TARTARIC.—*(Acid of Tartar.)*

It is doubted whether this acid be poisonous. In case of an overdose being swallowed, the treatment will be the same as directed for *Oxalic Acid.*

ALCOHOL.—*(Spirits of Wine, Brandy, Rum, Gin, &c.)*

The first object in cases of poisoning by spirituous liquors is to evacuate the contents of the stomach. This is best effected by the stomach-pump; emetics being frequently unsuccessful. Stimulants are then to be employed; the most effectual of which are—*cold water* injected into the ears and dashed on the head and neck,—*warmth* to the extremities when these are cold, and the internal use of ammonia (spirits of sal volatile or of hartshorn), also vinegar and water. If the patient appear to be dying from paralysis of the respiratory muscles, artificial respiration should be effected (page 13); if from closure of the larynx, tracheotomy may be performed. (See page 83.)

AMMONIA, CARBONATE OF.—*(Volatile Salt.)*
SPIRITS OF HARTSHORN.
SPIRITS OF SAL VOLATILE, &c. &c.

Give immediately some mild acid, as vinegar, lemon

or orange-juice; afterwards, any demulcent liquid, as milk, barley-water, &c.

In case of the accidental inhalation of ammoniacal vapour, the patient should *immediately* inspire the vapour of acetic or hydrochloric acid.

AMMONIA, HYDROCHLORATE OF.—*(Sal Ammoniac.)*

Vomiting to be excited artificially (if not already caused by the poison), and rendered easy by copious draughts of warm sugared water; afterwards, anodynes and antispasmodics. No specific antidote known.

AMMONIA, HYDROSULPHATE OR HYDROSULPHURET. *(Hepatized Ammonia.)*

In case of this liquid being swallowed in poisonous doses, a dilute solution of chlorine, or of the chlorides of lime and soda, should be immediately given, and the contents of the stomach be removed by the stomach-pump as soon as possible.

For the treatment of asphyxia from the inhalation of this and hydrosulphuric acid, see chapter II., article *Asphyxia from breathing noxious gases.*

ANTIMONY, TARTARIZED.—*(Tartar Emetic.)*

ANTIMONY, MURIATE OF.—*(Butter of Antimony.)*

In the first instance employ the same treatment as for the mineral acids, viz. magnesia, chalk, &c.; after-

wards, vegetable astringents, as strong tea, infusion of nut-galls or of yellow cinchona bark, should be administered to neutralize the remaining poison, and opiates to allay the continued irritability of the stomach.

ARSENIC, OXIDE OF, OR ARSENIOUS ACID.
(White Arsenic.)
ARSENIC, SULPHURET OF.
(Realgar, or Red Sulphuret; Orpiment, or King's Yellow.)

The first object being to expel the poison from the stomach, the stomach-pump should be immediately applied. If this be not in readiness, and vomiting have not commenced, tickle the throat with a feather or the finger, or give an emetic of sulphate of zinc (from 20 to 30 grains in water), but *tartar emetic is to be avoided.* Promote vomiting by draughts of demulcent liquids, as milk, gruel, flour and water, sugared water, lime-water, broths, &c. At St. Bartholomew's Hospital, about a quarter of a pint of the moist hydrated sesquioxide of iron* is administered in these cases, as

* To prepare this, dissolve 4 ounces of sulphate of iron in two pints of water, to which add 3½ drachms of sulphuric acid; boil them, and add, in small portions, 9 drachms of nitric acid, boiling the liquid for a minute or two after each addition, until of a yellowish brown colour. Filter, and when cool add, in a full stream, liquid ammonia, stirring the mixture briskly. Wash the precipitate thoroughly, and keep it under water in a stoppered bottle.

If hydrated sesquioxide of iron be not at hand, let the common red oxide be given mixed with water as a substitute; for, though less efficacious, it possesses some antidotal power.

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speedily as possible, in doses of a table-spoonful or more every five minutes, previous to the application of the stomach-pump, or by means of that instrument where the patient cannot be made to swallow. A viscid mixture is also used at that establishment, consisting of linseed-meal, castor-oil, and water, mixed to the thickness of treacle.

There is no antidote to be relied upon as a specific against this poison, though many substances have been extolled as such. Olive-oil is said by Dr. Paris to be used with confidence by the Cornish miners; but it can act only by enveloping the particles of arsenic, and preventing their contact with the gastric surface. Opium is a most valuable agent in relieving the subsequent distressing symptoms, which are to be combated upon general principles.

BISMUTH, TRISNITRATE OF.

(Oxide of Bismuth, Pearl-White, Face-Powder.)

Emollient drinks to be swallowed plentifully, as flour and water, milk, &c. &c. No specific antidote known.

BROMINE.

For treatment, see *Iodine.*

CANTHARIDES.—*(Spanish or Blistering Fly.)*

The poison to be removed from the stomach as speedily as possible by the stomach-pump, if the state

of the throat will admit of it; or by exciting vomiting, if not already present. This should be promoted by large draughts of any mucilaginous liquid, as linseed-tea, milk, gum-water, flour and water, &c. There is no chemical antidote known. The distressing effects remaining must be combated by bleeding, opium, the warm-bath, and clysters of oil and mucilage.

CHLORINE-WATER.

The antidote for poisoning by a solution of chlorine is albumen. The white of egg, mixed with water or milk (the caseum of which is as effective as the albumen of the egg), is to be given in large quantities. The compound which albumen forms with chlorine has little or no action on the animal economy, and may be readily expelled from the stomach. In the absence of eggs or milk, flour may be given, or magnesia or chalk.

COPPER, SULPHATE OF.—*(Blue Vitriol.)*

——— ACETATE OF.—*(Verdigris.)*

In general there is violent vomiting, the salts of copper acting powerfully as emetics. Give freely, warm water, milk, or any mucilaginous drink, to promote the efforts of the stomach. The stomach-pump is of little use when, as is generally the case, the poison has been taken in coarse powder.

The chemical antidote for the preparations of copper

is albumen; hence the white of eggs should be given, or, if not at hand, wheaten flour and water, or milk. Very strong coffee also assists in decomposing salts of copper, and should be given with plenty of sugar as a drink. Sugar, formerly in repute as an antidote, can act as such only at a *boiling* temperature.

CREASOTE.

In poisoning by this substance, the depression of the vital powers must be counteracted by ammonia and other stimulants. Chlorine has been recommended, and also oleaginous and mucilaginous drinks, for the purpose of preventing the local action of creasote on the mucous lining of the stomach and intestines. Artificial respiration should not be omitted.

FISHES, POISONOUS.—*(The Muscle, Conger Eel, Yellow-billed Sprat, &c. &c.)*

If the poisonous substance has been taken a short time only, give an emetic of sulphate of zinc (one to two scruples in water), followed by an active purgative; if several hours have elapsed, vomiting having occurred in the first instance, begin with a purgative, giving at short intervals draughts of vinegar and water, with ether (from half a tea-spoonful to a tea-spoonful) or other stimulants, as hot brandy and water.

GLASS OR ENAMEL COARSELY POWDERED.

Large quantities of crumb of bread should be eaten to envelope the particles; an emetic of one scruple of

sulphate of zinc should then be given, and vomiting promoted by demulcent drinks.

IODINE.

In cases of an overdose of the preparations of this substance being taken, the first object is to evacuate the poison from the stomach, promoting the vomiting by large draughts of demulcent liquids, especially those containing *starch;* as common starch, or wheaten flour and water, sago, arrow-root, milk, &c. These to be followed by opiates.

LAUDANUM.—*(Tincture of Opium.)* See *Opium.*

LEAD, ACETATE OF.—*(Sugar of Lead and Goulard's Extract.)*

—— CARBONATE OF.—*(White Lead.)*

—— PROTOXIDE OF.—*(Massicot, Yellow.)*

—— DEUTOXIDE OF.—*(Minium, Red.)*

Poisoning by lead assumes three forms,—*irritant poisoning, lead colic,* and *paralysis;* the first two only, being urgent, require noticing here.

In *irritant poisoning* administer diluents holding in solution some sulphate, (as sulphate of soda, sulphate of magnesia, or epsom salt,) so that an inert sulphate of lead may be formed. Then use the stomach-pump, or, in lieu of it, excite vomiting by tickling the throat, or by emetics of sulphate of zinc in dozes of one to two scruples.

In *lead colic* the best reputed remedy is alum, of which give from a scruple to two drachms, dissolved in water or gruel, every three or four hours; with castor-oil and opium to allay the vomiting and other urgent symptoms. The warm-bath will be also beneficial, and, under certain circumstances, blood-letting.

LIME.—*(Quick Lime.)*

Vinegar, lemon-juice, or any vegetable acid, to be freely administered, and afterwards demulcents.

LIME, CHLORIDE OF.—*(Bleaching Powder.)*

Administer albuminous liquids (as white of eggs beat up with water), or milk, or flour and water, or oil, or mucilaginous drinks, and excite vomiting; combat the inflammation of the stomach and bowels by the usual means. Acids are to be carefully avoided, which would cause the evolution of chlorine gas in the stomach.

MERCURY OR QUICKSILVER, BICHLORIDE OF.
(Corrosive Sublimate.)

The antidotes to this poison are *albumen, gluten of wheat, milk, (iron-filings?)*

Give immediately the whites of several eggs,* or

* One egg is considered requisite to neutralize every four grains of sublimate. *Note.*—Albumen may be given in too great quantity, the compound formed being soluble in excess of it, and, entering the blood, producing the remote effects of the poison. It should not be given after the vomited matters cease to contain a white opaque matter admixed.

wheaten flour with water, or *milk*, till either of these can be procured. The stomach having been thoroughly cleared by the stomach-pump or otherwise, give saline purgatives and emollient clysters.

NITRATE OF POTASH.

(Nitre or Saltpetre, Sal Prunelle.)

As there is no chemical antidote for this salt known, it should be cleared from the stomach as speedily as possible, by the stomach-pump or other means, letting the patient drink freely of milk, linseed-tea, gum-water, or other bland mucilaginous liquids.

PHOSPHORUS.

Give large draughts of water or any mild demulcent liquid, so as to envelope the phosphorus, and exclude it from the air contained in the alimentary canal. Magnesia should be given to neutralize the phosphoric and phosphorus acids which may be formed. Oily and fatty substances are to be avoided, as, by dissolving the poison, they would extend its operation.

Burns occasioned by this substance, which are not unfrequent, are extremely painful, and slow in healing; the parts affected should be washed thoroughly with a weak alkaline solution, to remove any adhering acid which might keep up irritation, and afterwards be poulticed.

The treatment for an overdose of phosphoric acid is the same as for sulphuric acid, which see page 14.

POTASH, CAUSTIC.—*(Pearlash, &c.)*

The patient should be made to swallow, from time to time, draughts of vinegar and water, lemon-juice, or other vegetable acid, to neutralize the poison, and afterwards bland demulcent fluids. *Oil* is also a good remedy, as it would unite with the potash, and form a soap, which may be readily got rid of by vomiting. As this poison quickly corrodes the stomach, no time should be lost in waiting for the above antidotes, but warm water should be drunk freely till they can be procured.

SILVER, NITRATE OF.—*(Caustic, or Lunar Caustic.)*

The antidote for this poison is *common salt*. Dissolve a table-spoonful of this in a pint of water, and give a wine-glassful every two or three minutes. The nitrate is thus decomposed, and an innocuous chloride of silver formed. Mild mucilaginous drinks should now be freely given, followed by purgatives, and opiates to allay irritation.

SODA, CAUSTIC.

The same treatment as for *Potash*.

TIN, PROTOCHLORIDE AND BICHLORIDE OF.
(Spirits of Tin, Dyers' Spirits.)

OXIDE OF.—*(Putty Powder.)*

Milk acts as an antidote to this poison, and should be drunk copiously. Vomiting should then be excited.

ZINC, SULPHATE OF.
(White Vitriol, White Copperas.)

ZINC, OXIDE OF.—*(Flowers of Zinc.)*

The violent vomiting usually present to be rendered easier by draughts of warm water: the patient should also drink freely of *milk*, which by partially decomposing the poison renders it less active.

VEGETABLE POISONS.
(Narcotic and Narcotico-irritant.)

OPIUM.—*(Also Preparations containing it, as Laudanum, Paregoric Elixir, Godfrey's Cordial, Dalby's Carminative, Dover's Powder, &c.)*

The stomach-pump should be employed as soon as possible, to clear the poison from the stomach. When not in readiness, an emetic of sulphate of zinc (from one to two scruples), or of sulphate of copper (from five to fifteen grains), in an ounce of water, should be given; the former is to be preferred. As *domestic emetics*, a dessert-spoonful of *flour of mustard*, or a table-spoonful or two of *common salt*, in a tumbler of water, may be given. To aid these means and to secure vomiting, as the stomach is frequently rendered insensible to them by the poison, the throat may be irritated by the finger or a feather. There is no known agent capable of destroying the activity of opium by its

chemical properties; infusion of galls is, however, regarded as the best, though an imperfect antidote, its action tending to neutralize the morphia. Dashing cold water repeatedly on the head, chest, and nape of the neck, or alternately cold and hot water, is an effective means of rousing the patient and promoting the operation of emetics. The poison being entirely expelled from the stomach *(but on no account before)*, the narcotic effects remaining may be greatly counteracted by vegetable acids. For this purpose drinks of vinegar and water, lemon-juice, or *cream of tartar and water*, may be given every ten minutes. Stimulants are sometimes advantageous, as strong hot coffee, brandy, or ammonia. As long as the drowsiness continues, the patient should be made to walk about between two persons, which may be necessary for several hours before it is safe to put him to bed. I have, in two or three instances, applied *galvano-electricity* in this stage, thereby effectually keeping the patient awake, and readily restoring him to sensibility. This perhaps would be inadmissible when there was evident cerebral congestion; in which case it would be proper (the poison being thoroughly withdrawn from the stomach) to abstract blood from the arm or jugular vein. The warm-bath also has proved useful in subduing the drowsiness; and, as a last resource, *artificial respiration** should on no account be omitted,

* See page 13.

a fatal termination having in several instances been averted by it.

TOBACCO.

In cases of this poison having been swallowed, the contents of the stomach should be withdrawn as speedily as possible. This is best effected by the stomach-pump; for want of which give immediately an active emetic, as a scruple of sulphate of zinc in water, or the domestic one of a dessert-spoonful of *flour of mustard*, repeating it if necessary, irritating the fauces to ensure vomiting. The narcotic effects will be best counteracted by *vegetable acids*, *strong coffee*, or *green tea*. When the depression of the vascular system is extreme, *ammonia* and *brandy* may be administered with good effect. Apopletic symptoms may require blood-letting, and *artificial respiration** should not be omitted when other means have failed. No chemical antidote has been discovered.

NUX VOMICA, STRYCHNIA, COLCHICUM *(Meadow Saffron)*; DIGITALIS *(Foxglove)*; HEMLOCK, BELLADONNA, COCCULUS INDICUS, ACONITE *(Monkshood)*, &c. &c.

There is no antidote to any of these poisons, and their general treatment is comprised in that laid down for *Opium* and *Tobacco*.

In animals poisoned by nux vomica, or its active

* See page 13.

principle strychnia, the symptoms, according to recent experiments by M. Duclos, have entirely subsided, and the animals been saved by the application of *negative* electricity; the *positive*, on the contrary, increased the muscular contraction produced by the poison, and hastened death.

The extract of the *cannabis Indica*, or Indian hemp, has lately been recommended as an antidote to the effects of strychnia; and, as it acts as a sedative, and produces the most complete relaxation of the muscular system without endangering the patient's life, even in a large dose, it merits a trial whenever it can be procured in time.

The spasms may be relieved by sedatives, as *extract of hemlock;* stimulants, as *ether* and *oil of turpentine*, have also been recommended.

Excessive irritation, caused by the external application of strychnia, may be relieved by applying *acetate of morphia* to the same spot.

CHAPTER II.

ON SOME OF THE ACCIDENTS OF MORE FREQUENT OCCURRENCE REQUIRING MEDICAL ASSISTANCE, WITH THE APPROPRIATE MEANS TO BE ADOPTED IN EACH CASE.

ABRASION OF THE SKIN.

When the surface of a part is abraded or grazed, our first object should be to remove, by means of tepid water, any sand or extraneous matter from the wound. It is then to be bathed with spirit and water till the pain has somewhat abated; and to defend the tender surface from the external air, a piece of dry lint is to be laid over it, or—what is better—lint or fine rag wetted with water, and over it a piece of oiled silk to retain the moisture.* Should there be much pain or swelling from inflammation, a poultice, or fold of linen moistened with the common Goulard lotion, may be laid over the lint; when this comes off, if the skin have not healed, it is to be dressed with any simple cerate.

* Called the '*water-dressing*.'

APOPLEXY.

When a person falls down in a fit of apoplexy, he should be immediately raised up, and his head kept supported, so as to prevent a sudden bend of the neck. His neckcloth should be loosened, and cool air be freely admitted. All strong applications to the nose, as well as emetics, are hazardous, especially where *there is much turgidity and flushing of the face;* then *bleeding* will be requisite, followed by some active purgative, as calomel combined with jalap, &c. Where, however, there is no evident accumulation of blood in the vessels of the head, and the person is of a phlegmatic temperament, bleeding should be carefully avoided.

ASPHYXIA,

OR SUSPENDED ANIMATION.

The term ASPHYXIA is applied to the state of suspended animation produced either by breathing impure air or noxious gases, by drowning, by hanging or strangulation, by intense cold, and by lightning.

ASPHYXIA

FROM BREATHING IMPURE AIR OR NOXIOUS GASES.

The gases most frequently causing this state are *carbonic acid* and *sulphuretted hydrogen.*

CARBONIC ACID.

This gas, which, as Christison has shown, is a real and energetic poison of the narcotic kind, is generated from various sources: thus it is freely liberated in respiration; and the air which has been contaminated by continued respiration, as in close and crowded rooms, will operate fatally on the human system, partly in consequence of its being deficient in oxygen, and partly from the deleterious effects of the carbonic acid contained in it. It is also a product of combustion, fermentation, and the calcination of chalk of limestone, and is abundantly diffused through the shafts and galleries of coal-mines, where it is commonly called choke-damp. It is likewise met with in wells, cellars, and other excavations of the earth. The vapour of *burning charcoal*, which is a very compound mixture, owes its fatal properties to the carbonic acid contained in it, the proportion of which varies, being *less* when the charcoal burns vividly than when it is either beginning to burn or nearly extinguished. *Coal-vapour* is a compound of carbonic acid, sulphurous acid gas, and the sulphuretted and carburetted hydrogen gases, which emanations are equally fatal to life; but in consequence of their extremely irritating qualities, they give warning of their presence, and are therefore less liable to occasion fatal accidents: nevertheless, accidents from the combustion of coal do occur. The *vapour of a brick-kiln* is equally deleterious; the principal agent being

carbonic acid, although ammonia and muriatic acid are evolved.

There is a popular belief that the burning of a candle in a suspected mixture of carbonic acid and air is a satisfactory proof that it may be respired with safety; but recent observations have proved that this fact is not to be relied on as an indication of security. It is perfectly true that in gaseous mixtures, where a candle is extinguished, it would not be safe to venture; but the converse of this proposition is not true,—namely, that a mixture in which a candle burns may be always respired with safety.

SYMPTOMS.

The symptoms of poisoning by carbonic acid, when this gas exists in a fatal proportion in the atmosphere, are commonly as follows,—a sensation of great weight in the head; giddiness; a sense of constriction in the temples; a ringing in the ears, with a pungent sensation in the nose; a strong tendency to sleep, accompanied by giddiness and total loss of muscular power, so that a person falls as if struck to the ground. The breathing, at first difficult and stertorous, becomes suspended. The action of the heart, which on the first accession of the symptoms is very violent, soon ceases, and the person now falls into a state of complete coma, or apparent death. The warmth of the body still continues; the limbs remain flexible, but in some cases become rigid, or even convulsed. The countenance is generally of a

livid or leaden colour, especially the eyelids and lips. The commencement of the above symptoms has sometimes been accompanied by a pleasing sensation of delirium, while at others the most acute pains have been suffered.

TREATMENT.

A person suffocated by carbonic acid should be immediately removed into the open air; and, his clothes being taken off, he should be placed on his back, with his head somewhat elevated. The coldness of the atmosphere, even in winter, ought to form no obstacle. Cold water should be dashed freely over the body, and bottles of hot water at the same time applied to the feet. Stimulants may be employed, either internally or in the form of frictions, and aromatic vinegar or ammonia may be held to the nose. The face and body should be sponged with eau-de-Cologne, brandy, or vinegar and water, and, if practicable, slight shocks of electricity or galvanism be passed along the channel of the nerves, from the seat of the phrenic nerve in the neck to that of the diaphragm. But the most important remedy is the artificial *inflation of the lungs*, in the mode already described (page 13). When symptoms of recovery begin to appear, the patient should be placed in a warm bed, with the windows of the room thrown open. Stimulants may be given in small quantities, and cold acidulated drinks freely, which, as well as being refreshing, are thought to communicate

oxygen to the blood in circulation, thus relieving the stupor ordinarily remaining for some time after.

If required to enter a room suspected to contain carbonic acid gas, the air breathed may be purified in the following manner. Dip a handkerchief, piece of flannel, &c. in a weak solution of potash or of lime, or even in common water, and apply it to the mouth and nostrils. The oxygen is allowed to enter the lungs, but the carbonic acid is stopped.

SULPHURETTED HYDROGEN.—*(Hydrosulphuric Acid.)*

This gas when breathed in its pure state is almost instantaneously mortal, and exerts its deleterious effects upon all orders of animals, and upon all the textures of the body, destroying life even when applied to the skin. The cases of poisoning by sulphuretted hydrogen are mostly accidental, and occur to nightmen and others who are engaged in cleaning out drains and sewers, or in the removal of the soil of privies. The vapour, however, arising from these sources is a compound mixture of atmospheric air and hydrosulphuret of ammonia, which latter is constantly exhaling from the water of the soil, and causes the offensive odour resembling rotten eggs.

The *symptoms* produced by the respiration of this gaseous mixture are nausea, cold skin, loss of all power of sense and motion, lividness of lips and face, hurried and laborious respiration, with spasmodic twitchings

of the voluntary muscles, especially those of the chest, the limbs and trunk remaining in a state of general relaxation.

TREATMENT.

This must be conducted on the same principle as cases of asphyxia produced by carbonic acid, which see. Chloride of lime (or chloride of soda) is the best antidote to hydrosulphuric acid, hydrosulphuret of ammonia, and sulphuret of potassium, as well as for hydrocyanic acid: it decomposes and renders them inert. A solution of this should be administered by the stomach, and a sponge or handkerchief soaked in the solution held near the nose, so that the vapour may be inspired. If a person be required to enter a place suspected of containing sulphuretted hydrogen, a handkerchief moistened with a solution of chloride of lime, applied to the mouth and nostrils, so that the inspired air may be purified before passing into the lungs, will enable him to do so without danger. It was by this means that Mr. Roberts (the inventor of the miner's improved safety-lamp) was enabled to enter and traverse with safety the sewer of the Bastile, which had not been cleansed for thirty-seven years, and which was impregnated with hydrosulphuric acid.

SULPHUROUS ACID GAS.

(The vapour arising from burning Brimstone.)

When this gas has been inhaled, the patient should

be made to inhale, with due caution, the vapour of ammonia (page 12); and a few drops of the solution of it should be swallowed.

ASPHYXIA FROM DROWNING.

Complete submersion under water for the space of one or two minutes induces a state of asphyxia or suffocation. This is owing to the water acting as a mechanical impediment to the entrance of air into the lungs, in the same manner as a rope or ligature around the neck; for although air escapes from the lungs, and water penetrates into the bronchiæ, yet no air can enter to supply the place of that which has already expended a certain quantity of its oxygen on the blood. Hence this fluid, if it circulate at all, must do so in a state unfitted for the support of existence, and death will ensue. This will take place in a period varying with different individuals. But as submersion for a few seconds only will give to a body all the characters of apparent death, we are not to hesitate to employ immediately every means in our power to restore animation. Moreover, as there are several well-attested instances of resuscitation after submersion for five minutes, and one indeed after fourteen minutes (the longest *authentic* one on record),* we are bound to persevere in our efforts for at least two hours. In the case last alluded to, resuscitation began to be feebly

* See Med. Gaz., vol. xxxi., page 449.

established only after eight hours and a half spent in the treatment.

THE TREATMENT.

On being got out of the water, the body, laid on the side, and the head and chest raised, should be immediately removed on a plank or shutter to the nearest house, or to a warm and dry situation. Having cleansed the mouth and nostrils from froth, mucus, &c., the next important step is to strip the body of its wet clothes, to rub it quickly dry with hot cloths, and, till a warm bed or blankets can be prepared, to cover it with the spare clothes of the bystanders. Heat should be applied in every possible way: the hot-bath will be the most efficacious of any, and should always be employed where the circumstances of the case will admit. In the mean time bottles filled with hot water should be applied to the arm-pits, feet, and pit of the stomach. The means, however, most to be relied upon is the effecting artificial respiration. This is to be accomplished in the manner described (see page 13), the old mode of introducing air into the lungs by means of bellows, &c. being now justly discarded; there being not only the strongest evidence against its utility, but also sufficient to warrant the conclusion that much mischief has been occasioned by it, and many lives lost that might have been saved.

During the attempt to restore respiration, friction with hot flannels should be unremittingly applied to

the body and extremities, and volatile stimulants held to the nose. Warm clysters, with salt and mustard, or brandy and water, may be administered, and warm spiced wine got into the stomach by means of the stomach-pump, or a flexible catheter and syringe,—not to be attempted, however, without such assistance, till the patient can swallow.

Electricity and galvanism will be found invaluable adjuncts to the above means, and should, whenever practicable, be had recourse to where the respiration is not quickly restored. The author has in two instances employed electro-galvanism with complete success.

Bleeding is occasionally useful, but requires the utmost caution. The abstraction of a small quantity of blood from the external jugular vein may in some cases relieve the engorgement of the venous system of the brain; but it should not exceed from an ounce and a half to three or four ounces, as a larger quantity would probably extinguish the remaining feeble powers of vitality.

ASPHYXIA FROM HANGING OR FROM STRANGULATION.

The cause of death in both these cases is the same, and in hanging takes effect in three ways:—1st. By dislocating the neck. 2nd. By compressing the trachea and suspending respiration. 3rd. By compressing the

jugular veins, thereby inducing apoplexy. A mixed condition of the two latter states is supposed to exist in the majority of cases. In strangulation a much greater degree of violence is commonly employed than is sufficient to produce asphyxia, thus lessening the probability of resuscitation: the facility with which this may be effected will depend probably on the different degrees to which asphyxia or apoplexy has extended.

TREATMENT.

This should be conducted on precisely similar principles to that recommended for drowned persons, with the exception of the application of heat, which is here unnecessary. Artificial respiration, performed in the mode already described (page 13), will prove the most important step, and should be immediately effected. If the face be turgid, a small quantity of blood should be taken from the jugular vein, and cold water be dashed frequently and briskly on the face and chest. These means will be powerfully assisted by passing a current of galvanism or electricity from the nape of the neck to the pit of the stomach, so as to excite the action of the diaphragm. (For the means of performing this, see chapter III., page 80.)

ASPHYXIA FROM INTENSE COLD.

Although a moderate degree of cold is well known to have an invigorating effect upon the body, and,

indeed, as long as the living power is capable of producing a reaction, is one of the most energetic tonics we possess; yet when very severe, and the exposure to it long continued, especially if it be accompanied with wind, rain, or sleet, it proves the most formidable sedative in animal chemistry: the skin becomes pale, the muscles stiff, especially those of the face and extremities, and contract with difficulty; sensibility speedily disappears; a state of torpor ensues, followed by profound sleep, from which the person cannot be readily roused, and the vital functions gradually cease. These effects are accelerated by certain conditions of the body. Thus in all cases where there is exhaustion of the nervous system, as in the aged and infirm—in those who are worn out by disease or fatigue—or, lastly, in those addicted to the use of intoxicating liquors, the fatal effects of cold are much more rapidly manifested than in others who are healthy and temperate. Young infants also, especially when newly born, very easily perish from the effects of cold.

TREATMENT.

The great object of our endeavours in this case ought to be the restoration of the body to its natural heat. If this be attempted by the sudden and immediate application of warmth, the destruction of the patient will be the certain consequence; but if it be done gradually, raising the temperature by almost

imperceptible degrees, we shall accomplish the object desired, with very trifling inconvenience. According to this plan, we should commence with rubbing the body with iced water or snow; then with water of the usual temperature: at the same time warm air may be breathed into the lungs, and the stomach and rectum gently excited by moderate stimulants; for it does not follow that, because the limbs and surface of the body are frozen, the central parts have suffered to the same extent. The enema may be composed of warm water and a table-spoonful of salt, to which a little spirits of turpentine may be added; but tobacco, which was formerly recommended by the profession in such cases, and is still popularly considered to be of great service, must not on any account be used,—it would surely be prejudicial, and perhaps deadly. Afterwards, when the warmth and sensibility are a little restored, the body should be wiped perfectly dry, wrapped in fur or flannel, and laid in bed in a moderately warm room, continuing the friction by warm hands of several persons. The after-treatment must be entirely regulated by the state of the patient; the strength must be supported by mild cordials and nutriment, care being taken not to excite feverishness or headache.

ASPHYXIA FROM LIGHTNING.

The electric fluid appears to act by producing a violent shock to the brain and nervous system, occasion-

ing the symptoms of concussion of the brain. The whole system seems to be suddenly exhausted of its entire stock of nervous power, like a Leyden phial upon an application of the discharging rod; in consequence of which the limbs are flexible, the countenance pale, and the blood uncoagulable. Such, at least, are the effects usually stated to take place; but experiments carefully performed on animals tend to show that there is nothing in the action of the electric fluid to prevent or retard the coagulation of the blood, since that in the veins of animals killed by the discharge of a powerful galvanic battery was invariably found in a solid state. The former condition, if it ever do exist, may, however, be conceived to be the effect of the greater degree of intensity of the lightning stroke.

TREATMENT.

The body in these cases retains its warmth for some time even after death has actually taken place; and the first thing to be done is to strip off the clothes, and dash cold water upon it in considerable quantities for ten or fifteen minutes: this, in slight cases, will speedily bring about a reaction. It should also be assiduously rubbed, and artificial respiration be effected in the manner already described (page 13). Stimulants of the most active kind are to be resorted to, but that of *electricity* or *galvanism* is the one specially called for in this modification of asphyxy. Its good effects

have been strikingly shown in experiments on animals by M. Abildgaard (related in the Transactions of the Copenhagen Medical Society). The animals were first rendered asphyctic, or apparently dead, by a strong shock of electricity passed through the head; and afterwards recovered by another shock passed through the chest, from the breast to the back,—the animal instantly walking about as if nothing had happened. Where no second shock was employed, the apparent was converted into real death,—the animal in no instance showing any tokens of resuscitation: moreover, if the second shock were thrown through the head like the first, instead of through the chest, the same lifelessness continued, and no benefit whatever was produced.

CAUTIONS TO PERSONS OVERTAKEN BY A THUNDER-STORM.

Never take shelter under a tree, hay-stack, wall, or hedge, such objects attracting the lightning and endangering any one near them. It will be best to keep in the middle of the field or road, *especially if raining*, the lightning often passing harmlessly over a body whose surface is wet. Above all, do not hold up an umbrella, more particularly one of the *German* ones with iron frames, the use of which at such times is highly dangerous.

ASPHYXIA OF INFANTS STILL-BORN.

The best step to commence with here is the warm-bath, of the temperature of about 95°, in which the child may be kept for ten or fifteen minutes; during which time the lungs should be inflated by means of a small female catheter inserted into the larynx, to be performed by a medical man only, or by blowing into the child's mouth through a piece of flannel laid over it, and alternately emptying the lungs by pressing the chest and belly as before described. The heat is to be kept up by the application of warm flannels. Stimulating applications may also be rubbed on the spine and over the pit of the stomach.

BITE OF RABID ANIMALS (*Hydrophobia*).

As there has been hitherto no remedy discovered which can be said to possess a specific control over this dreadful malady, and therefore little hope can be entertained of a cure for it, our best endeavours should be directed to the *preventive* treatment. This is to be commenced, then, by completely cutting out the whole wound as soon as possible after the bite of a suspected animal. After this, bleeding should be encouraged by immersion in warm water, or the application of a cupping-glass. Caustic should next be applied to every part of the wound, which is then to be covered with a poultice and suffered to heal by granulation, or be

kept open, and made to suppurate by irritating ointments. The excision should never be omitted, even though the bitten part have healed, and let the interval since its occurrence be what it may. As for any of the innumerable so-called specifics, there is not one that is worth a moment's trial.

With regard to the treatment after the disease has become fairly established, almost every conceivable remedy has been employed, several being reported to have effected a cure; while on being tried in other hands they have proved of no benefit at all, or at best but mere palliatives for the moment. Thus *bleeding* may be tried, if the patient be plethoric and the face becomes very turgid during the spasms. The injecting *warm water into the veins* after bleeding has afforded temporary relief. *Opium*, given in large doses, has seldom failed to mitigate the patient's sufferings, though it never averts his death. In one instance the *liquor plumbi diacetatis* (Goulard's Extract of Lead) is said to have effected a cure. In another, the suffocative spasms were entirely relieved by letting the patient eat large quantities of ice, and applying it externally to the spine and throat; and the last thing that has been tried is the resin of Indian hemp: but a brief respite from suffering is the utmost good they can produce. There is an experiment which has been proposed, but not yet tried on the human subject; namely, the production of a state of asphyxia by

means of inoculating with the *Woorali* poison, and the gradual restoration of the patient to consciousness by means of artificial respiration. And there really seems to be some reason for hoping that, by thus suspending the functions of the nervous system, the effects of the poison may gradually cease before the strength is quite exhausted. The plan has been tried with success on animals affected with tetanus, and in a hopeless case would certainly be justifiable.

BITE OR STING OF VENOMOUS INSECTS.

There are no insects met with in England whose bite or sting is of sufficient importance to need surgical assistance, unless inflicted in extraordinary numbers or in peculiar situations. Children, if much stung by bees or wasps, may suffer considerably from fever. But the most common instance of danger from these insects is the alarming suffocation produced when their sting is inflicted in the pharynx or back part of the mouth; which sometimes happens when they are concealed in fruit, and are incautiously taken into the mouth.

TREATMENT.

If there be fainting or constitutional depression, opiates and cordials must be given without delay; for example, spirit of sal volatile, or of hartshorn, a tea-spoonful in a wine-glassful of water, or a glass or two of wine at intervals. As to the local treatment,

the first thing to be done is to examine the part with a lens, and extract the sting, if left in the wound, as is frequently the case, with forceps, or—what will generally answer the purpose—the barrel of a watch-key strongly pressed over it. The best local applications will then be sweet oil, either alone or mixed with spirit of hartshorn, finely-scraped chalk, flour, vinegar, spirit of wine, brandy, or eau-de-Cologne. Either of these will give relief in the above case, and also in the bites of bugs, fleas, gnats, mosquitoes, &c.

In the case of a wasp or bee sting in the throat, attended with danger of suffocation, leeches should be plentifully applied both externally and internally; and hot stimulating gargles (hot water and salt, for instance,) be frequently used to reduce the tumefaction, by causing a copious flow of blood and saliva. But if these measures fail of affording relief, an opening must be made into the larynx or trachea. (See page 83.)

BURNS AND SCALDS.

There is no accident respecting the treatment of which so much difference of opinion exists as this; authorities of equal respectability and experience advocating the most opposite remedies. Some recommend in the case of a slight burn or scald, insufficient to produce any constitutional depression, the immediate application of cold in any convenient form, and its continuance until pain and inflammation have sub-

sided. Others adopt a directly opposite course, employing in the first instance stimulants, both externally and internally. The latter plan was introduced about forty years ago by Mr. Kentish of Newcastle, and is generally called by his name; and there is no question but that, in all cases severe or extensive enough to endanger life by the great depression of the vital powers, it is the safest to be adopted. It consists, whether the skin be removed or not, in bathing the part burnt or scalded with a piece of soft linen dipped in warmed spirit of turpentine or of wine, and then as quickly as possible covering it with a liniment composed of spirit of turpentine (one part) and basilicon ointment (two parts) thickly spread on lint or linen rag. This dressing should remain on as long as possible, and not be removed unless there be a profuse discharge or bad smell from the wound. Notwithstanding a slight smarting may be at first occasioned by the above applications, a soothing sensation in a very short time succeeds, and the patient feels comparatively easy.

In dressing extensive burns, care should be taken to avoid exposing more than a small part at a time; and if blisters have arisen, they should on no account be punctured, as is often done with a view of relieving the tension. But this latter is of no importance, and will speedily subside; while the cuticle is the best possible covering to the injured part, and it should be

a leading object to keep it entire whenever it can be done.

The *cotton* method of treatment consists in enveloping the parts burned with finely-carded cotton wool, spread out of equal thickness; upon this a second and third layer is placed, according to the profuseness of the discharge,—the whole being encircled with a bandage. This dressing is allowed to remain till the fifth day, when the whole is removed, and the surface of the sore is generally found to be in the most favourable state to heal with the ordinary simple dressings, as the zinc or chalk ointment, or common cerate. Should the cotton be found to adhere to the sore, no force is to be used to separate it; but a poultice of bread and water (or bread and linseed-meal together) is to be applied over it, which in a few hours will enable it to be removed without violence or pain. Poultices must also be resorted to, or the *water-dressing* described at page 29, when the surface is very irritable and painful, giving a mild opiate at night, followed by an aperient. The constitutional powers, when greatly depressed, must be supported by diffusive stimulants, such as hot brandy and water, ammonia, and ether, according to the urgency of the case, continuing the use of these till reaction is completely established, but not pushing them so far as to induce congestion in the head or chest, or aggravate the succeeding fever and inflamma-

tion. The system is to be kept up during the treatment by beef-tea or other mild nutriments.

The proportion of severe cases *cured*, since the adoption of the cotton wool, has very greatly increased; while the favourable termination is brought about in half the time it formerly was.

It remains only to mention several remedies which have obtained popular reputation in these accidents, and which are valuable, not only as giving more or less relief, but as being generally at hand, or to be readily procured in every dwelling. They are—*wheat flour*, which may be thickly sprinkled over the injured parts with a common kitchen dredger, till a perfect crust is formed;—an excellent application. *Finely-scraped chalk*, or *magnesia*, applied in the same way. These act both by excluding the atmospheric air, and absorbing the fluid secreted by the vessels of the inflamed surface. Another application, reported to be very efficacious in allaying the pain, is a piece of lint wetted with a saturated solution of *carbonate of soda*. A poultice of grated raw *turnip* or *potato*, applied cold, is quickly productive of ease in slight burns, but requires renewing often enough to keep up the sensation of coldness. There is a nauseous compound of linseed-oil and lime-water frequently used, and known by the name of "Carron oil" (from being used at the iron-works of that name); it has nothing to recommend it in preference to any of the above-mentioned remedies,

unless it should chance to come first to hand. It is employed in the healing of severe burns, to keep the parts soft and prevent their contracting or adhering, which object it may effect as well as any other greasy application.

Scalds of the Glottis, through swallowing boiling water, an accident not uncommon with children who are in the habit of drinking from the spout of a tea-kettle, produce the ordinary symptons of laryngitis—suffocative cough and difficult respiration.

Treatment.—Leeches, ice to the throat, calomel in large doses, so as rapidly to affect the system, and tracheotomy if required. (See page 83.)

COMPRESSION OF THE BRAIN.

The symptoms of this accident are those of apoplexy. They are insensibility; stertorous breathing; slow, labouring pulse; dilated and insensible pupils (in some cases, however, these are contracted, and sometimes one is contracted and the other dilated).

The compression may be caused either by a portion of bone being forced in upon the brain from fracture, from blood extravasated, or from matter formed within the cavity of the skull.

TREATMENT.

The head should be shaved and carefully examined; and if there be no sign of fracture, the case may be

treated as one of apoplexy: the remedies required being blood-letting, cold applications to the head, and active purgatives of calomel and jalap. If fracture occur with extravasation, the trephine may be used,* provided symptoms of excitement have not come on. In that case we can only deplete very freely to avert inflammation, enjoin the strictest quietude, and keep up a constant action of the bowels.

CONCUSSION OF THE BRAIN, OR STUNNING.

This is an interruption to the functions of the brain, resulting from a blow, fall, or other mechanical injury to the head, not necessarily attended with structural injury to the brain itself. The patient usually lies for a time motionless and insensible; if roused and questioned, he answers hastily, and immediately relapses into insensibility: after a time, he moves his limbs as if in uneasy sleep, vomits, and frequently recovers his senses instantly afterwards; remaining, however, giddy, confused, and sleepy for some hours. The pulse is feeble and intermittent, and the breathing slow, or performed only by a feeble sigh drawn at intervals. These symptoms, following the accident *immediately*, distinguish this from *compression* of the brain resulting from extravasation.

* See Cooper's "First Lines," or any text-book on surgery, to ascertain when the trephine should be applied.

TREATMENT.

In every case of sudden insensibility, whether from disease or accident, the vulgar clamorously demand that the patient be bled. But we are by no means to perform this operation, as a matter of course, the moment we are called to a person in this state: we must wait till a reaction takes place, and the pulse rises; and till this occurs it will be best to leave the patient to recover by himself, and not be too officious in administering stimulants, which may increase the mischief to the brain.

Reaction having come on, bleeding will be requisite to prevent inflammation of the brain; the bowels must be thoroughly acted upon, and perfect rest with low diet strictly enforced. If the pulse become hard and frequent, and if the patient complain of pain or tightness in the head, the bleeding and purgatives should be repeated as often as may be necessary, and the head also be shaved and kept wet with evaporating lotions.

CONTUSIONS OR BRUISES.

In slight bruises, and those not likely to be followed by much inflammation, nothing more is usually necessary than to bathe the part with spirit, as eau-de-Cologne, brandy, &c., mixed with an equal proportion of vinegar and water. In more severe cases, however, and where the accident is near an important part, as the eye, or any of the joints, it becomes a desirable

object to prevent the approach of inflammation. This is to be attempted by the application of leeches, repeating them according to circumstances. Should there be considerable fever present, bleeding from the arm, purgatives, and a low diet may become necessary.

In the last stage of a bruise, where there is merely a want of tone in the parts, and swelling from the effused blood, &c., friction should be employed, either simply or with any common liniment or opodeldoc. Wearing a bandage, pumping cold water on the part, succeeded by warm friction, also a saturated solution of common salt in water, have each been found beneficial. The roots of briony and Solomon's seal, bruised and applied as a poultice, are efficacious in hastening the disappearance of the lividity of bruises.

CONVULSIONS OR FITS IN CHILDREN.

When children are attacked with convulsive fits, the most active means should be promptly employed, since there is danger of the fit proving fatal. The best remedy is the warm-bath, in which the child is to be placed and retained till the fit goes off. It must not, however, be unnecessarily repeated. The cold-bath, exposure to a current of cold air, and sprinkling cold water on the face, have been severally found useful in shortening the attack. In every case, purgatives, particularly of calomel, and an injection, will be proper. In many cases, leeches to the temples, and a

blister to the back of the neck, are required. When the fits appear to be connected with acidity or flatulency, a little calcined magnesia in peppermint-water, with a few drops of spirit of sal volatile or of the fetid spirit of ammonia, will be useful; and if caused by the irritation of teething, free scarification of the gums should not be omitted.

DRUNKENNESS.

When called to a person in a state of deep intoxication, our first care should be to secure a free admission of fresh air, by opening the windows of the room and preventing the patient being surrounded by an unnecessary crowd of attendants. He should be laid in a recumbent position, with his head to one side to favour vomiting, which should be excited by tickling the back part of the throat with a feather, &c.; or, if that should fail, by an active emetic,—a very efficient one presenting itself in the common flour of mustard, of which a desert-spoonful or more may be given. Cold water dashed over the head and face will promote the action of this on the stomach, and also tend to remove the stupor. When the insensibility and lethargy are great, and the breathing stertorous and oppressed, it will be proper to abstract blood either from the arm or jugular vein.*

* For the mode of performing the latter operation, see chapter III., on the Minor Operations, page 76.

EAR, SUBSTANCES IN.

The passage of the external ear does not extend more than half an inch in length, being closed at the bottom by a membrane called the *tympanum*. Medical men are sometimes called in to extract some hard substance that has become lodged in the passage, such as a pea, cherry-stone, bit of slate-pencil, &c. among schoolboys and children. If the substance be within sight, and can be grasped *readily* with a small pair of forceps, that will be the best way to extract it; but to accomplish this, *force must on no account be used*. By far the best and safest method is to inject luke-warm water pretty forcibly into the ear, by means of a rather powerful syringe (it should be one that will hold at least two ounces, to be efficient for the purpose). This will rarely be found to fail; the water passing beyond the substance, and being there confined by the tympanum, forces the former *outwards*. It occasionally happens that the foreign body has become firmly fixed, either from its having swelled through the moisture, as a pea, &c. is apt to do, or from the surrounding parts having become swollen; in which case, should a few trials with the syringe not succeed, and the ear be very tender, it will be the better plan to pour into the ear a little sweet oil, and leave it till the next day, when the syringing may be renewed. I have seen a child relieved of a bead by his mother placing his head

between two pillows on the table, the affected ear downwards, and striking the upper one smartly once or twice, when the bead dropped out. Glass beads and similar substances have been extracted by a probe, dipped into some appropriate cement, being introduced into the ear, and kept in contact with the body to be removed for a few moments till it has become set.

EYE, SUBSTANCES IN.

A substance getting accidentally in the eye may either lie disengaged on its surface, or, having penetrated the external coat, may there remain fixed. In the former case, it is easily removed by a camel-hair pencil, or a piece of paper rolled into the size of a crow-quill, with the end softened in the mouth. It is very common for the substance to stick in the cornea, when, if it cannot be removed with a probe or fine forceps, the point of a lancet should be carefully passed under it so as to lift it out. If, however, the removal cannot be effected without considerable difficulty, it is better to leave it to be detached by ulceration, taking every precaution to keep off undue inflammation, by avoiding a strong light, fomenting with warm water, &c. To remove fine particles of gravel, lime, &c., the eye should be syringed with luke-warm water till free from them; enjoining the patient afterwards to abstain from worrying the eye, under the impression that the substance is still there, which the enlargement of some

of the minute vessels makes him believe to be actually the case.

EPILEPSY.

During the epileptic paroxysm, in general little or nothing is to be done, except using precautions that the patient do not injure himself. His clothes should be loosened, particularly about the neck; his head elevated, and a piece of wood or cork put between his teeth to prevent injury to the tongue. Should there be considerable determination of blood to the head, or the patient be very plethoric, it may be proper, if he can be kept steady, to open a vein or the temporal artery. In weakly constitutions, the most powerful antispasmodics might be tried in the form of an injection, as they could hardly be swallowed. An emetic, when it can be got down, will always remove the fit where it has been induced by drinking strong liquors. Care should be taken not to give the patient a cup or glass to drink from during the convulsive paroxysm, as he will be apt to bite a piece from such vessels, and injure his mouth; as was the case with a child under the author's care, who was with much difficulty prevented from swallowing the portion of glass bitten out.

THE GLANDERS.

This is a disease originating in the horse, and occasionally communicated to man by contact. It occurs

in two forms: one seated in the *lymphatic system*, when it is termed *farcy*,—the other affecting the nasal cavities, called *glanders*. But these two forms are essentially identical; the matter of either of them will produce the other; and farcy always terminates in glanders, if the animal live long enough, and its progress be not arrested. The *acute* glanders is mostly fatal; the *chronic* has sometimes, though rarely, been recovered from.

TREATMENT.

The chief points to be attended to in the treatment of glanders are—to open all the abscesses as soon as they form; to syringe the nasal cavities with solutions of creasote; and to support the strength and abate the thirst with wine and soda-water. Injections of creasote have cured both the acute and chronic glanders; but almost any other treatment that can be named has been of no service. Depletion is inadmissible. The offensive effluvia must be counteracted by fumigations of chlorine, or the solution of chloride of soda or of lime constantly applied to the parts, and sprinkled about the room. Similar treatment will apply to farcy, any swollen glands being extirpated.

FAINTING, OR SYNCOPE.

A person in a fainting fit should be immediately placed on his back, and cold fresh air be as freely admitted as possible: this cannot be accomplished while

the patient is surrounded by a crowd of persons, which should therefore be prevented. The face should be sprinkled with cold water, volatiles held to the nose; and as soon as the patient can swallow, recovery will be expedited by a glass of wine, or a few drops of ether or of sal volatile in water.

When syncope or fainting occurs after a considerable loss of blood, it is the natural means of preventing the progress of the hæmorrhage to a fatal extent: the patient, therefore, in such cases, should on no account be attempted to be revived by plying him with cordials and spirits, as is constantly done. (See following article *Hæmorrhage*.)

HÆMORRHAGE.

FLOODINGS AFTER LABOUR.

The foregoing observations concerning the safety of *syncope*, occurring in cases of ordinary hæmorrhage, do not hold good in cases of floodings after labour, wherein syncope should always be regarded as a very dangerous indication. That permanent contraction of the womb, which is essential to the patient's safety, can only be secured by maintaining a condition of the system quite the reverse of syncope. No time must be lost. The following means must be resorted to with the greatest promptitude, as a single rush of blood may at any moment place the patient beyond all chance of recovery.

Bearing in mind that an uncontracted womb is the cause of the bleeding, with both hands applied to the abdomen over that organ, press down firmly, and with a grasping action of the fingers endeavour to bring it to its proper globular contracted state. The powers of the patient should be supported by stimulants, given largely. Brandy and laudanum is an excellent combination, viz. half a wine-glassful of brandy and half a tea-spoonful (thirty drops) of laudanum,—a dose which may be repeated in proportion to the failing strength of the patient. A sound and tranquil sleep following that restless jactitation or tossing of the limbs, &c., the forerunners of fatal syncope, is the most certain evidence of the return of the womb to its contracted condition.

Cold will be found an excellent auxiliary in the treatment. Ice pounded and strewed between the folds of a wet cloth, or, better, cold water poured in a stream from a height, and allowed to fall suddenly on the abdomen, the hands of the person pressing on the womb being from time to time withdrawn, contributes much to secure the object in view.

From first to last, every care must be taken to prevent the patient from assuming, even for a moment, the upright posture.

HÆMORRHAGE FROM WOUNDED BLOODVESSELS.

Nothing is more alarming to unprofessional persons than to see a profuse flow of blood gushing from a wound,—no accident, perhaps, so calculated to disturb the presence of mind of bystanders, who might often, by adopting one or two simple expedients, avert *immediate* danger till a surgeon could be procured. These expedients I will now point out, as well as the usual professional means of arresting hæmorrhage. If the bleeding be from a wounded *artery*, (known by the blood being of a bright scarlet colour, and being ejected in *jets*, corresponding to the beating of the pulse,) it will be both more dangerous and more difficult to restrain. Whether it be from an artery or vein, however, the first thing to be done, either by the wounded person himself or a bystander, is to apply one or more fingers, according to the extent of the wound, to the place from whence the blood flows. This will suspend the hæmorrhage, while other more important remedies are being got ready.

First, a firm conical plug is to be prepared from a piece of lint, rag, or sponge, of a size suitable to the extent of the wound; then, having a basin of cold water and sponge brought, the wound is to be freely washed, clearing away any clots that may be in it, so as completely to expose the spot whence the blood issues. The point of the plug should then be inserted,

and pressed upon the bleeding orifice, and there secured by a roller, or a handkerchief folded in form of a cravat. The cleansing of the wound alone, and exposing it to the cold air, will often cause the bleeding to cease. Should the blood continue to pour out, in spite of the above measures, the better plan will be to remove the whole application, and trust to the pressure of the fingers alone, until the arrival of a surgeon, or a person acquainted with the nature and treatment of such accidents. We will suppose, however, that the hæmorrhage is for the present arrested, but that, from the depth and importance of the wounded vessel, it is necessary to have some means of restraining it under still more complete control. For this purpose a tourniquet should be applied to the limb,—a simple and efficacious substitute for which is a silk pocket-handkerchief folded as a cravat, with a knot tied firmly in the middle of it. This is to be tied securely round the limb, above the wound, the knot being placed upon the course of the main bloodvessel to be compressed;* and for the purpose of tightening this bandage, should it become necessary, a short stick (a round ruler, for instance,) should be kept at hand, by putting which through the handkerchief, and giving it a few

* There will be no difficulty in finding the place where the pad or knot is to be fixed, when it is recollected that the main artery passes downwards along the inside of the limb, from the centre of one joint to the centre of that next beneath it; as, for example, from the centre of the arm-pit or groin to the centre of the bend of the elbow or knee.

turns, any degree of pressure may be obtained, as with a tourniquet.

Of the means of stopping hæmorrhage employed by surgeons, the ligature is without doubt the most secure, and is required in all cases of wounds of large arteries. To apply this is no very difficult operation; but, as it is not likely to become a domestic one, it is unnecessary to describe it here. If an artery of small size be wounded, as the *temporal*, in cupping, &c., the best plan is to cut the artery completely through, when the ends will retract within its sheath; a compress is then to be applied, and confined by a bandage passing round the head. The pressure is to be kept up for some days, to prevent a false aneurism being formed.

The other means consist of styptics of various kinds. Some of these check the bleeding by opposing a mechanical obstacle to the exit of the blood, as the *agaric*, *German tinder*, *spider's web*, &c.; others by coagulating the blood, or by causing contraction of the bloodvessels, as *spirits*,—astringents, *alum*, *cold water*, or *ice*. Others, again, excite the adhesive inflammation and formation of granulations; for example, the tincture of steel, turpentine, creasote, and nitrate of silver, or lunar caustic. They are all applicable to the same cases as cold and pressure; namely, when the bleeding vessels are numerous and small. A *pinch with a pair of forceps* will often cause small vessels to cease bleeding. It remains to mention one

more styptic only, the most potent of all; namely, the '*actual cautery*,' or *hot iron*. If this be applied *red hot*, it stops bleeding mechanically, by burning up the orifices of the vessels; but the bleeding is liable to return as soon as the eschar separates. It is better, therefore, to use the iron at a *black heat;* for it then excites the adhesive inflammation, and is very efficacious for arteries that either cannot be tied, or that are too diseased to hold the ligature.

In all cases of hæmorrhage which there is any difficulty of restraining, it is most essential to keep the wounded person in a perfectly quiet state, in the recumbent position, and from all food or drink of a stimulating nature; the apartment also should be kept very cool.

HÆMORRHAGE FROM LEECH-BITES.

This is sometimes a very troublesome source of bleeding, and, with children, not unfrequently a dangerous one. In most cases it may be stopped by pressing into the holes small pledgets of lint dipped in spirit of wine, or the muriated tincture of steel, or touching them with a pointed piece of lunar caustic. If neither of these methods succeeds, it will be requisite to pass a stitch, with a fine needle and silk, through each of the bleeding orifices. In the case of children and delicate persons, directions should always be given that the bleeding should be stopped before the patient

is left for the night. Moreover, if practicable, it will be well to apply the leeches over some bone, in order that the pressure, if required, may be applied effectively.

HÆMORRHAGE FROM THE NOSE.

This may sometimes be regarded as salutary, as when the person is red-faced, plethoric, and subject to headache and giddiness; in which cases it should not be restrained too suddenly. If it be very profuse and difficult to stop, the patient should be bled from the arm: a small quantity of blood abstracted in this way will often at once check bleeding from other parts, and is the safest practice. Purgative medicine must at the same time be given, and all stimulants avoided. Epsom salts, in repeated small doses, with the dilute sulphuric acid, form perhaps the best medicine for these cases.

There are various other means in use for checking the hæmorrhage,—the upright posture, cold applications to the head and face, a piece of cold metal applied to the back, compression of the nostrils, &c. If these means fail, recourse must be had to plugging the nostrils with lint or sponge. Even this is insufficient in some cases, when the posterior openings of the nostrils must also be plugged. The plugs should be left undisturbed for two or three days, during which the patient should keep as quiet as possible, and avoid a stooping posture.

PLUGGING THE NOSTRILS.

Ascertain whether one or both nostrils require plugging. The following proceeding will be necessary for each:—

1. Fasten a piece of sponge, or lint rolled up tolerably hard, a little larger than the end of the thumb, to the middle of a piece of cord, so as to leave two ends, each about ten inches long.

2. Pass a long piece of thread through the eye of a common silver probe, or any other convenient instrument of the same size with a hole in it, and not sharp at the ends; and carry it back cautiously along the *floor* of the nostril until it appears at the back of the mouth.

3. Take hold of the end of the thread with a pair of forceps or blunt-pointed scissors, and bring it out at the mouth. Withdraw the probe from the nostril, so as to leave one end of the thread hanging from the nose, and the other still hanging from the mouth. To this attach beth ends of the cord connected with the plug; and then, by pulling the end of the thread at the nostril, the plug is carried backwards into the throat (assisted if necessary), and upwards against the posterior aperture of the nostril. The two ends of the cord now hanging from the anterior aperture are to be separated, and tied firmly over a plug of similar material applied there. Both plugs are thus firmly retained until it is considered prudent to remove them.

HYSTERICS.

During the paroxysm, cold water, vinegar, or eau-de-Cologne may be sprinkled on the face, pungent applications made to the nostrils, and warm friction applied to the extremities. If the patient can swallow, half a tea-spoonful of ether, with ten or fifteen drops of laudanum, or a tea-spoonful of the aromatic spirit of ammonia (sal volatile) in water, may be administered.

LEECHES ESCAPED INTO THE STOMACH.

This accident occasionally happens in applying these animals to the gums, or back part of the mouth, and, if unobserved, may lead to very serious results, especially in children. If discovered at the time, however, there will be no difficulty in dislodging the leech, even though it have fastened to the coat of the stomach; a tea-spoonful or two of common salt dissolved in water should be instantly swallowed, and repeated after a little time if necessary. This will speedily kill the leech, and cause it either to be vomited up, or, at all events, to pass through the bowels without any ill consequences. Half a wine-glassful of wine, given every quarter of an hour, for three or four times, has also been found a certain method of getting rid of a leech from the stomach. A leech having fastened itself to the back of the throat may be dislodged by

a gargle of salt and vinegar. In case of one getting into the rectum, which has occurred, an injection of salt and water is to be administered.

SPRAINS.

In a recent sprain, our first object is to prevent inflammation. This is best effected by the application of cold lotions, such as one composed of equal parts of spirit, vinegar, and water. The part may also be supported by a moderately tight bandage; and perfect rest, in the horizontal position, should be enjoined. But should inflammation have come on, it will be proper to apply leeches; and in this case it is almost impossible to apply too many. A poultice, moistened with the Goulard lotion, should be afterwards applied; keeping the bowels open by saline purgatives. If, notwithstanding these measures, the fever, heat, and swelling continue unabated, the patient should be bled from the arm, and the application of the leeches repeated. The stiffness and weakness remaining after this accident is to be removed by friction, gentle exercise of the joint, &c., as recommended under the article *Contusions.*

THROAT, SUBSTANCES IN.

A small substance lodging in the throat, as a fish-bone, pin, &c., may sometimes be readily got rid of by

exciting vomiting by tickling the back part of the throat; sometimes by making the patient swallow a good mouthful of bread-crumb. Another expedient is to introduce a large goose-quill down the throat, and then twirl it round,—by this means the substance may be disengaged, and pass down into the stomach. Occasionally it is merely engaged in the folds of the gullet, and is carried down by a plentiful draught of water, or—what is still better—the white of an egg, and if necessary a second, which the author has repeatedly found successful.

When the substance is large, especially if rough, hard, or angular, it should, if possible, be brought up through the mouth; for which purpose a pair of long curved forceps, or a piece of whalebone, armed with a flat blunt hook, or with a skein of thread, so as to form a great number of nooses, are convenient instruments. If the substance be soft (as a piece of meat), it may be pushed down into the stomach with the probang,—a long piece of whalebone, with a bit of sponge fixed to the end of it. This, previously softened with water, or a little oil, is to be carefully introduced, keeping the end directed to the *back* of the throat, so as to avoid the aperture of the windpipe; then pushed down the gullet with moderate force, till the substance reaches the stomach.

If all means fail, however, and the substance can neither be got up nor down, and if it be lodged very

low in the throat, it must be extracted by cutting into the œsophagus. (Page 85.)

WOUNDS.

These are classed under four heads; viz. the *incised*, or those which are occasioned by some cutting instrument; the *lacerated*, or those caused by parts being violently torn asunder; the *contused*, or that species arising from a blow, by which the vitality of the part is destroyed; and the *punctured*, or those made by a sharp-pointed instrument, which, of all the varieties of wounds, are most to be dreaded, on account not only of their more immediate but their remote effects. From this description of wounds arise tetanus, locked jaw, &c.

INCISED WOUNDS.

Treatment.—The bleeding, which is sometimes considerable, is to be checked by moderate pressure, the application of cold, and the raised posture; but if an artery have been wounded, or the bleeding prove obstinate, recourse must be had to the measures directed under the head of *Hæmorrhage* (see page 62). The wound must be cleared of any foreign bodies, also all clots of blood, which will act in the same way, by preventing adhesion of the sides thereof. After this, the parts are to be brought together neatly, closed by strips of sticking-plaster (placed across the wound), and supported by a bandage. Spaces should be left between

the strips of plaster, for the escape of any matter which may be formed, or blood which may be effused, which would otherwise act as extraneous substances, forcing the lips of the wound asunder, and rendering the suppurative process necessary to heal it. If the cut have divided a muscle transversely, it will be necessary to place the limb in such a position that the divided muscle may be relaxed, by which means the edges of the wound will be much more readily retained in apposition.

There are a few cases where *sutures* will be required; parts where the skin is very moveable and loose, as the eye-lids, cheeks, lips, &c. It will generally be left for the medical man to employ these; but, as a necessity for their use may arise where the aid of one cannot be obtained, a word or two on the subject may not be out of place in a manual intended for the use of emigrants and families residing in secluded parts of the country.

It will be sufficient to explain the mode of using one suture only—the *interrupted*, as it is termed. A needle armed with a ligature of silk, or stout thread, well waxed and flattened, is to be passed through one lip of the wound, *from without*, inwards; then, at a corresponding part, through the other lip, *from within*, outwards. Then the ends of the silk are to be drawn together, but without any forcible straining, and are to be tied tightly in a double knot.

The needle should be passed deep enough to obtain a firm hold, but must not on any account penetrate a tendinous part, or a muscle, which would occasion inflammation and violent spasm. As many stitches are to be made as the length of the wound renders necessary, spaces of half to three quarters of an inch being left between them; and across these spaces strips of adhesive plaster, several inches long, should be placed, to prevent any strain upon the stitches. In the case of a triangular wound, where a flap of skin or flesh hangs loose, a single stitch, placed through the *raised* angle, will be generally sufficient, with the strips of plaster to keep it in place.

LACERATED WOUNDS.

These differ from the other species in the circumstance of there usually being but little hæmorrhage from them. Sometimes whole limbs have been torn off with little or no blood being lost. These wounds are often dangerous, on account of their containing extraneous substances; and they are more likely to be succeeded by tetanus than either the *incised* or the *contused* species.

Treatment.—The wound is to be washed very clean with warm water and a piece of soft sponge, carefully removing all extraneous substances; after which the sides of the wound are to be brought into apposition, to afford the chance of their uniting by adhesion, if

disposed to do so. A linseed-meal poultice is then to be applied over the whole of the injured part, and, if the pain and inflammation be great, leeches also. The patient may require bleeding, if there be much irritation of the system. Opium also may be freely employed in these cases, the action of the bowels being previously regulated.

CONTUSED WOUNDS.

These are occasioned by the collision of a blunt instrument or surface against a part of the body; under these circumstances, it would be absurd to attempt union by the adhesive process. Such wounds are not merely lesions of continuity, but are accompanied by such force and violence done to the substance of the part that suppuration and sloughing generally ensue, if the force applied have been sufficient to destroy the vitality of the part.

The *treatment* is to remove carefully any extraneous matters, to apply leeches, fomentations, and poultices. It is also requisite, if the injury be extensive, to support the constitution under the process by tonics and stimulants. After the bowels have been opened, opium and antimony are the best internal remedies.

PUNCTURED WOUNDS.

These are justly considered the most dangerous of all wounds. From their depth, they are liable to

injure bloodvessels, nerves, viscera, and other deep-seated parts of importance. They are, likewise, most liable to be followed by tetanus.

Treatment.—In the first place, rest, low diet, purgatives, cold lotions, and leeches must be sedulously employed, to counteract all excess of inflammation, and to cause the absorption of any blood that may be effused in the course of the wound. But if, notwithstanding, there should be severe pain and swelling, with fever, a free incision must be made for the relief of tension and the discharge of matter; and the case must be treated in the same manner as a deep-seated abscess.

CHAPTER III.

ON THE MINOR OPERATIONS.

BLEEDING.

THIS is usually performed at the bend of the arm; and the vein selected should, if possible, be the *median-cephalic* (that which runs from the centre of the bend towards the outer side of the arm). A ligature of tape or ribbon being placed a little above the elbow, to interrupt the return of the blood, and cause the vein to swell (but not so tight as to stop the pulse at the wrist), the operator takes hold of the arm with his left hand, placing his thumb on the vein a little below the intended puncture, and then pushes the lancet obliquely forwards into the vein, making it cut its way out by elevating the point directly upwards.

When sufficient blood has been taken, the ligature is removed, the thumb placed on or just *below* the orifice to check the bleeding, and the wound is closed by a small compress of lint: this is secured by a band-

age passed diagonally across the bend of the arm, the ends being carried round, one above, the other below the elbow, brought in front, and made to cross each other immediately over the puncture, in the form of the figure eight; they are then secured by tying them together.

Bleeding may be performed, also, at the back of the wrist, at the ancle, and at the neck. The best vein to select, in the first of these situations, is that which is seen running up the arm from the back of the thumb. That in the second is the *internal saphenic*, which is seen taking its course from the great toe along the internal border of the leg, in front of the inner ancle. The *external saphenic*, which passes behind the outer ancle, may be opened if it appear the larger of the two, which is rarely, however, the case. The mode of opening these veins is similar to that described for the bend of the arm; but, in addition, it is usual to immerse the hand or foot in warm water to promote the bleeding.

The *external jugular* vein, on either side of the neck, is sometimes opened in cases of apoplexy in adults, and in children when the veins at the elbow are hidden by fat. It is an operation neither dangerous nor difficult, and is performed in the following manner. The vein is to be compressed just above the collar-bone, either with the thumb of the operator's left hand, or by placing upon it a thick pledget of lint, &c.,

confined there by a bandage tied under the opposite arm-pit. The vein being then fixed by two fingers of the left hand, an opening is to be made in a direction rather across it; and this should be somewhat wider than is usually made in bleeding at the arm. The stream of blood may be directed into the basin by a folded card, or other similar contrivance, to prevent its trickling down the breast; and when a sufficient quantity has been taken away, a piece of common sticking-plaster is to be placed on the orifice, and over that a pledget, which is to be kept in place by a bandage or handkerchief wound gently round the neck.

CUPPING.

This useful, and sometimes invaluable, operation is too familiarly known to need a description; and to give written instructions for its performance must ever be so much labour lost, since these never yet enabled an unpractised person to perform it; and to a practised hand they would of course be useless. It is an operation that must be learnt by the eyes and fingers, under the practical instruction of a skilful cupper.

To those, however, who have performed the operation, although not perhaps with the full success they could have wished, a few hints may be useful, and may ensure better success in future. And first, if they have chanced to read, in books on cupping, the very proper caution against exhausting the glasses *too much*,

they had better, if beginners, dismiss from their minds any fears on that score, as the grand difficulty with such is to produce a vacuum more than just sufficient to make the glass keep its hold; the non-issuing forth of blood being a source of considerable wonderment, as well as mortification. To exhaust the glass *effectually* is what should be taught in the first place, and to use the power *with moderation*, when you have acquired it, afterwards. To accomplish the first object, let the wick of the spirit-lamp be of considerable thickness—an important point; let the glass be dipped into warm water, drained but not wiped, and then holding it, the mouth downwards, just near enough to the part to allow the flame to be introduced into it without burning the patient's skin, pass the flame fairly within it, instantly withdrawing it, and, at the moment of doing so, fixing the glass firmly on the skin. This, in one or two minutes, will produce a great afflux of blood to the part. And to remove the glass, apply the scarificator, and re-apply the glass, before this afflux of blood and the swelling have subsided, is the main point upon which the success of the operation depends; it is to be acquired by practice alone, but will not be attended with any great difficulty to a person of ordinary quickness and dexterity. Another point is to see that the blades of the instrument are perfectly clean and sharp; for if they are blunt or notched, they will make a *torn* wound, which will not

bleed, besides the additional pain inflicted; and if in a dirty state, the patient may be inoculated with some foul complaint, or, at least, suffer a long time before the wounds heal. The blades, again, should not be set too deep, or the incisions will be choked up with portions of sub-cutaneous fat, &c., and the flow of blood be thus mechanically obstructed; besides which, the advantage of the determination of blood to the *cutaneous* vessels of the part, caused by the application of the glass, will be entirely thrown away; a quarter of an inch will, in most cases, be sufficient for the depth of the blades—one-third of an inch as deep as can ever be required.

ELECTRICITY AND GALVANISM.

Although these powerful agents have been by turns overrated and decried, and have lost much of their therapeutical reputation through having been resorted to by quacks, in desperate cases, where no benefit could possibly arise from them, still no one who knows how to use them can doubt their efficacy. The results, in some of the cases, have been remarkable, and in most have given equal satisfaction to the physician who prescribed the remedy, and the patients who were the subjects of it. Galvano-electricity possesses many advantages over the ordinary kind, and seems far more extensively applicable to disease. The apparatus consists of a double coil of wire on a

cylinder, the ends of one coil connected with a single-cell battery on Smee's principle (with amalgamized zinc and platinized silver), the ends of the other connected with the directors to be applied to the patient. As a means of making and breaking contact, there should be attached to the above a small horse-shoe magnet, with a bar of soft iron, round which is twisted a coil of copper wire, the ends dipping into a cup of mercury: this bar, working on a pivot between the poles of the magnet, acquires the polarity of each in turn, and, being therefore repelled, a constant revolution is kept up.

The cases in which the above remedy has been principally beneficial are—defective circulation and nervous influence; in rheumatic affections of the joints; in paralysis of the extensors from long disuse, or from the effects of lead; in weakness of limbs after disease, as of the thigh after sciatica; in dyspepsia from inactivity of the liver, or a weakness of the muscular coat of the stomach; in incontinence of urine, from paralysis of the muscular coat of the bladder; in deficient menstruation; in hysterical neuralgia, and other cases of nervous pain unattended with increased vascularity. In these, and many other cases, I have observed its good effects. It is also particularly applicable to cases of *asphyxia* from hanging or poisoning, when other stimulants fail to excite the action of respiration. The best method in these cases is

to place one wire at the nape of the neck, and the other at the pit of the stomach; or, if the sensibility be so feeble that this fails to take effect, a needle may be inserted deeply between the eighth and ninth ribs on either side, so as to reach the diaphragm, and the galvanic current be passed between them. In very obstinate neuralgia, it is a good plan to introduce two needles deeply, at two points in the course of the nerve, and to pass a current through them.

ISSUES.

An issue may be made either by caustic, or by incision, or by the actual cautery. If the first be preferred, the method is to make a paste with equal parts of caustic potash and soap; then to put on the part several layers of sticking-plaster, each having a hole in it of the size of the intended issue, which is to be filled with the paste; this is to remain on till the skin is converted into a black slough. Afterwards, the part is to be poulticed till the slough separates; and then the sore may be prevented from healing, either by binding one or more peas firmly on its surface, or by touching it occasionally with the caustic. The second kind of issue is made by pinching up the skin, and slitting it up with a lancet, and then introducing some peas to prevent it from healing. It is to be observed that issues should never be made over pro-

jecting points of bones, nor over the bellies of muscles, for they might degenerate into most obstinate sores.

The *actual cautery* is a very efficient, and far from being the most painful manner of effecting counter-irritation; it is performed by means of an iron rod, with a knob at the end of it of the size and shape of an olive. The knob, being made red hot, is rubbed on the skin, so as to make two or three blackened lines about half an inch wide and an inch apart. Then a poultice is to be applied till the eschars separate,—the sores to be kept open by touching them occasionally with the cautery.

LARYNGOTOMY AND TRACHEOTOMY.

The first of these operations is the more quickly and easily performed, and is to be preferred in sudden emergencies; but the latter more readily admits the removal of foreign bodies, and is always to be chosen in cases of suffocation from disease.

Laryngotomy is performed by cutting at once through the *crico-thyroid* membrane, which may be felt as a soft depression about an inch below the *pomum Adami* or Adam's apple.

Tracheotomy is thus performed:—The patient's head being thrown back, a superficial incision, an inch and a half to two inches long, must be made, exactly in the median line, from the cricoid cartilage to the top of the sternum. The skin, superficial fascia, and

fat are then divided; the sterno-hyoid muscles are separated with the point of the knife; the loose cellular tissue and veins are cleared from the front of the trachea with the fingers, or the handle of the scalpel; the thyroid gland, if in the way, is pushed up; then, the patient being told to swallow, the surgeon seizes the moment whilst the trachea is stretched, and thrusts the knife in, with a slight jerk, at the lower part of the wound, carrying the edge *upwards*, so as to divide three or four of its rings. The operator must take great care to keep in the middle line, and must be very cautious not to cut *downwards* at the lower part of the wound, for fear of the large veins. Hæmorrhage may be arrested, if arterial, by the ligature; if venous, by nicely adapted pressure. As soon as an opening is made, the foreign body is usually expelled with a strong gust of air; but if not, it must be searched for with a probe, and be removed by forceps or a blunt hook. If there be any difficulty, the plan may be tried, recently practised with success (in Mr. Brunel's case), of turning the patient with his head downwards, in order to let the substance fall through the *rima glottidis* (aperture of the windpipe); and it may be remarked that, as soon as an artificial passage is made for the patient to breathe through, the great irritability of the natural aperture subsides, so that it permits the body to pass. The wound may be closed by plaster when the bleeding has ceased, but not before.

ŒSOPHAGOTOMY.

This operation should be performed on the side towards which the foreign substance projects. Its situation having been ascertained, an incision of sufficient length must be made through the skin and platysma muscle, between the sterno-mastoid muscle and trachea. The cervical fascia must next be divided on a director. The surgeon must then divide the cellular membrane with a blunt knife, or with his fingers, avoiding the carotid and the thyroid arteries, and the recurrent nerve. A common silver catheter may then be passed down the throat, and be made to project in the wound, so that the œsophagus may be opened by cutting on it. This small wound in the œsophagus should then be dilated with forceps, in order to avoid hæmorrhage, and the foreign body be extracted.

THE STOMACH-PUMP.

This instrument consists of an elastic-gum tube, about two feet long, attached to a powerful syringe. The tube, previously oiled, is to be passed into the œsophagus till it reaches the stomach; in introducing it, the end should be directed towards the back of the throat, to prevent its entering into the aperture of the glottis,—a circumstance which has more than once occurred in unskilful hands. As a test of its having passed in the right direction, the flame of a candle

held to the opening of the tube, previously to attaching it to the syringe, will not be affected; if, on the other hand, the tube has passed into the windpipe, the air rushing from the lungs will agitate the flame. It is usual to place a gag in the patient's mouth, having a hole in it for the tube to pass through, in order that it may not be compressed by the teeth. Before pumping out the contents of the stomach, two or three pints of lukewarm water should be injected into it; this should then be withdrawn, and a fresh quantity thrown in, repeating the process till it returns free from colour and smell. Great caution is required in drawing out the latter portions of fluid, lest the membrane of the stomach be sucked into the hole at the end of the tube, and be injured; for this reason the stomach should *not be entirely emptied:* and should any obstruction to the working of the piston be felt, it will be prudent to withdraw the tube about an inch or so, in case the stoppage may be owing to the above cause; the impediment, however, frequently arises from bits of food clogging up the aperture of the tube.

Having thus described the manner of using this invaluable instrument, a point of no less importance remains; namely, to explain in what cases it should *not* be used. I say *not* be used, because, so high in popular estimation does the instrument stand, that there is always an impression on the mind of the public that it should be used in every case of poisoning; and some

self-conceited wiseacre will be found on every coroner's jury starting up to put the question, '*whether the stomach-pump had been used?*' censuring the unfortunate medical attendant for his shocking neglect if it had not. The uses of the stomach-pump, as Dr. Watson has well remarked, are simply two: that of conveying fluids into the stomach is one; that of extracting fluids from the stomach is another. Its use can therefore never be required whenever the patient is able and willing to swallow the necessary remedies, nor when full vomiting can be excited without it. It is indeed chiefly, if not solely admissible, where narcotic poisons have been taken, when the patient is in a state of insensibility, and the stomach insusceptible of the impression of emetics; or, again, when the patient obstinately refuses to swallow, as is frequently the case with attempted suicides. In all such cases the stomach-pump offers an admirable resource, and overcomes a most perplexing obstacle to our curative endeavours.

VACCINATION.

The success of this operation will depend partly on the state of health of the patient,—for it will most probably be defeated if there be any cutaneous disease, or disorder of the system generally,—and partly on the quality of the matter which is inoculated. The matter should be taken on the eighth day, before an inflamed areola is formed around the vesicle; and it should be

lymph, clear and transparent, not purulent. The operator should make three punctures on each arm with a fine lancet, carrying the point of the instrument obliquely under the cuticle for about one-eighth of an inch, and, if possible, without drawing blood. Then, if he have a patient to take the matter from, he ruptures a portion of a vesicle, dips the lancet into the lymph, and inserts it into each puncture. If he has the matter on points, or on pieces of glass, he should breathe on them so as to liquify it, and then insert a point into each puncture, or the lancet charged from one of the glasses.

CHAPTER IV.

ON CHEMICAL ANALYSIS, AND THE TESTS FOR THE PRINCIPAL POISONS.

A CHEMICAL analysis in toxicology is commonly directed to the determination of two points:—1. Of the nature of the poison. 2. Of the proportion, or quantity, in which it has been taken.

Of the nature of the poison.—In the present state of our knowledge, Chemistry, with few exceptions, furnishes us with the means of identifying with certainty a *mineral* poison only. The greater number of vegetable poisons are beyond the reach of chemical analysis. Botanical characters may sometimes serve to point out the nature of the substance; but it is in those instances only where the plant has been swallowed with its leaves or other parts entire. If the extract or inspissated juice have been used (the plan always adopted by brewers), or if the poison were in the form of infusion, tincture, or decoction, a chemical analysis will

commonly be of no avail. The same remarks apply to the powerful alkaloids extracted from vegetables. It is true that there are tests for morphia, strychnia, and a few others; but these are, on the whole, unsatisfactory as a basis for chemical evidence of poisoning. Again, poisons which are of a highly volatile nature may be speedily dissipated, so that in a few days or a few hours after death none may be discovered; of which alcohol and prussic acid may be cited as examples.

The *quantity* of poison administered is generally stated conjecturally; but it is sometimes possible to give a tolerably accurate statement of the quantity taken, when any portion of the original vehicle of the poison is discovered. Thus, all solid substances given for analysis should be first weighed, and all liquids measured; a *quantitative* analysis may then be performed at any subsequent period. For the mode of conducting this, and *the process of separating poisons from organic mixtures*, the student is referred to works on Toxicology, in which they are fully detailed; the object of the author here being merely to give a brief catalogue of the principal tests in use, to save time, and refresh the memory, taking for granted some preliminary acquaintance with the mode of using them.

To a person who has not been in the habit of analyzing poisons, it may be useful to suggest that,

before he commences the analysis of the substance in hand, he should operate several times upon a portion of the same kind of poison as that which is suspected to have been administered. In the employment of chemical tests, it is especially necessary to determine that they are pure, before the analysis is commenced. Arsenic may be contained in the sulphuric or hydrochloric acid, in an analysis of that poison; and sulphuric acid may be pronounced to be present in the stomach, when it may have been contained in the nitric acid employed in the analytical process.

Another point to be observed, in conducting an analysis, is to use the smallest possible quantity of the suspected liquid or solid. If all were used at one operation, doubts might afterwards arise in the mind of the analyst, which it would be out of his power to remove. By care and ordinary precaution a few grains will give results as satisfactory as those obtained from several ounces; and there is this additional advantage, that a portion is saved for the corroborative experiments of other analysts, or for correcting those which may have been previously performed.

CHEMICAL TESTS.

SULPHURIC ACID.

This may require to be examined under three conditions:—1. In its simple state. 2. When mixed with organic matters, as the contents of the stomach.

3. On solid organic substances, as where the acid has been thrown or spilled on articles of dress, &c.

In the simple state. — If *concentrated*, it possesses these qualities:—1. A piece of wood or other organic matter plunged into it is immediately carbonized or charred. 2. When boiled with wood, copper-cuttings, or mercury, it evolves fumes of sulphurous acid; this is immediately known by the odour, as well as by the acid vapour first rendering blue and then bleaching starch-paper dipped in a solution of iodic acid. 3. When mixed with an equal bulk of water, great heat is given out. For the acid in the *diluted* state but one test need be applied;—a solution of a salt of barytes—the nitrate of barytes, or the chloride of barium. A dense white precipitate (sulphate of barytes) is thrown down, which is insoluble in all acids and alkalies.

It is sometimes required to detect the acid when spilled on articles of clothing. The process of analysis is very simple. The piece of cloth, linen, &c. is to be digested in a small quantity of distilled water at a gentle heat, whereby a brownish-coloured liquid is commonly obtained on filtration. If sulphuric acid be present, the liquid will have a strong acid reaction, and produce the usual effects with the barytic test. Another very delicate test is to introduce into a short piece of glass tube, about an eighth of an inch in diameter, and closed at one end, a minute piece of the spotted cloth: the tube is then gently heated; and at

the same time a piece of paper previously saturated with starch, and moistened with a drop of iodic acid, is brought near the mouth of the tube. The blue iodide of farina is immediately produced by the sulphurous acid formed at the expense of the sulphuric acid in the cloth. This may be confirmed by negative results, from experimenting on other portions of the cloth unstained by sulphuric acid.

NITRIC ACID.

(Aqua-fortis.)

This acid may be met with either concentrated or diluted. The *concentrated* acid varies in colour from a deep orange-red to a light straw-yellow. It may be recognised,—1st. By its evolving acid fumes when exposed. 2nd. By its staining organic matter yellow or brown, the colour being heightened and turned more of a red tint by contact with ammonia. 3rd. When mixed with a few copper cuttings, it is rapidly decomposed,—a deep red acid vapour is given off, and a greenish-coloured solution of nitrate of copper is formed. Tin or mercury may be substituted for copper in this experiment.

Tests for the acid in a *diluted* state.—1st. Dip into the acid liquid a piece of bibulous paper previously wetted with a weak solution of potash; on drying and igniting this, it will be found, if the acid were the nitric, that the paper burns with deflagration. 2nd

Carefully neutralize the liquid with potash, and evaporate it slowly to obtain crystals. Take a portion of these, powdered; place them in a small tube mixed with their bulk of fine copper filings; moisten the mass with water, and add a few drops of strong sulphuric acid. Either with or without the application of a gentle heat, a decomposition immediately ensues, by which the red fumes of nitrous acid are evolved, recognisable by their colour, odour, and acid reaction; this test is conclusive of the presence of nitric acid. Another satisfactory test is the boiling the suspected nitric acid, or solution of nitrate, with a few drops of hydrochloric acid and leaf-gold, when the gold will become dissolved,—a fact made evident, if not by the entire disappearance of the metal, by adding to the liquid a solution of protochloride of tin.

The process for detecting nitric acid spilled on clothing is similar to that described for sulphuric acid, using the appropriate test; but, unlike the latter, it will be of little avail if not tried within a week or two of the spots being made.

HYDROCHLORIC ACID.

(Muriatic Acid—Spirit of Salt.)

When pure, this acid is colourless; but the commercial acid has a deep lemon colour, and is commonly not so concentrated as to possess the property of fuming in the air, which depends upon its strength. It tinges

organic substances of a yellow colour, and corrodes them. When boiled with black oxide (*peroxide*) of manganese, in fine powder, chlorine is evolved, known by its colour, odour, and bleaching properties on litmus and other colouring matters,—a test which is conclusive. A single drop of the acid, in a tube of very small bore, will give satisfactory results.

When the acid is much *diluted* with water, the property of evolving chlorine with peroxide of manganese is lost. In this case there is a most satisfactory test in the *nitrate of silver*, which gives, with the acid, a dense, white, clotted precipitate of *chloride of silver*. This precipitate possesses the following characters:—It is insoluble in nitric acid—very soluble in caustic ammonia—insoluble in caustic potash;—by which it is known from all other white salts of silver. The dilute hydrochloric acid is also known from the dilute nitric and sulphuric acids (or when mixed with either of these) by boiling the liquid with a slip of bright copper and a few drops of a solution of arsenious acid. If hydrochloric acid be present, the copper acquires a grey coat of metallic arsenic,—with nitric and sulphuric acids it retains its lustre unchanged. To detect this acid on clothes, &c. spotted with it, digest a portion of the spotted part in warm distilled water, and proceed with the silver test as above.

The spots produced on black cloth by strong hydrochloric acid are at first of a *bright red*, and in ten or

twelve days change to a red-brown. Sulphuric and nitric acids produce *brown* and not *red* stains on black cloth. An unstained portion of cloth should always be examined by way of comparison.

HYDROCYANIC OR PRUSSIC ACID.

TESTS.—This acid is distinguished, 1st, by its *odour*, resembling that of bitter almonds. If the quantity of poison be small, and it remain exposed to the air for some time, the odour may entirely disappear, as it is of a very volatile nature.

2. *Nitrate of Silver.*—This will give, with prussic acid, a dense white precipitate,—identified as *cyanide of silver*, by its insolubility in *cold* nitric acid, its solubility in solution of potash (with free prussic acid present), and by its yielding cyanogen gas when dried and heated in a small reduction-tube: this gas may be burnt at the mouth of the tube with a rose-red flame.

3. *The production of Prussian blue.*—For this purpose, add to the liquid a few drops of the solution of potash, and of sulphate of iron,—a dirty green precipitate falls. On shaking this for a few minutes, and then adding diluted hydrochloric or sulphuric acid, the liquid becomes blue,—the well-known Prussian blue, unaffected by diluted acids, subsiding.

OXALIC ACID.

TESTS.—1. *Nitrate of Silver.*—This, when added to a solution of oxalic acid, produces an abundant white precipitate of *oxalate of silver.* This is completely dissolved by nitric acid, and, when dried and heated on platina-foil, is entirely dissipated in a white vapour with a slight detonation.

2. *Lime-water* and all the *salts of lime* give a white precipitate. The first is objectionable, being precipitated white by many acids. The salt of lime least objectionable is the *sulphate.* A solution of this must be added, in considerable quantity, to the suspected liquid, when a fine white precipitate of *oxalate of lime* is slowly formed, which should possess the following qualities:—1st. It ought to be immediately soluble in nitric acid. 2nd. It should not be dissolved by the tartaric or any vegetable acid.

There are other tests, but they add no force to the evidence afforded by the above.

TARTARIC ACID.

This is distinguished from other acids by its throwing down a white precipitate (bitartrate of potash) from a solution of any of the salts of potash; separating that alkali from every other acid. It forms a white precipitate with lime-water, which is readily dissolved by excess of the acid.

The three caustic alkalies, ammonia, potash, and soda, are known from the solutions of the alkaline earths by the fact that they are not precipitated by a solution of carbonate of potash. They all three possess a powerful alkaline reaction on test-paper, which in the case of ammonia is dissipated by heat.

Ammonia is immediately known from potash and soda by its odour and volatility. If the solution in water be very dilute, the odour may be scarcely perceptible. The alkali may then be discovered,—provided we have first assured ourselves, by evaporating a portion of the liquid, that potash and soda are absent,—by adding to the solution a mixture of arsenious acid and nitrate of silver. The well-known yellow precipitate of *arsenite of silver* will be instantly produced. In addition to these characters, ammonia re-dissolves the brown oxide of silver which it precipitates from the nitrate, while potash and soda do not. It also forms a blue solution when added in excess to the sulphate of copper.

Caustic Potash and Soda are best known from their respective carbonates by giving a brown precipitate with a solution of nitrate of silver. The carbonates, on the other hand, yield a whitish yellow precipitate. Caustic potash is known from caustic soda by its being precipitated in granular white crystals, on the addition

of an excess of a strong solution of tartaric acid. A fine platina wire, perfectly clean, dipped into the alkaline liquid, and then dried by holding it above the flame of a spirit-lamp, will be covered with a thin film of solid alkali. On introducing this into the colourless part of the flame, the flame will acquire a lilac colour, if it be potash,—a rich yellow colour, if it be soda. This test applies also to the salts of the alkalies.

The carbonate of either alkali is known from the bicarbonate by the fact of the former yielding a white precipitate with a solution of sulphate of magnesia, while the latter is unaffected by that test.

AMMONIA, HYDROCHLORATE OF.

(Sal ammoniac.)

This may be detected,—1. By the ammoniacal odour being evolved, on rubbing it with *quick-lime*, or with *carbonate of potash*. 2. By *nitrate of silver*, which throws down a white precipitate of chloride of silver from its solution.

ANTIMONY, TARTARIZED.

(Tartar Emetic.)

TESTS.—1. *Dilute nitric acid* added to the solution throws down a white precipitate (subnitrate of antimony). The other two mineral acids act in the same way; but, as they precipitate numerous other metallic solutions, there are objections to them which do not

hold with respect to nitric acid. The white precipitate thus formed possesses the remarkable property of being entirely dissolved in a solution of tartaric acid; it is also soluble in a large excess of nitric acid, so that, if much of the test be added at once, no precipitate is formed. 2. *Hydrosulphate of ammonia*, or *sulphuretted hydrogen gas*, produces in the solution an orange-red precipitate (hydrated sesquisulphuret of antimony), differing in colour from every other metallic sulphuret.

ANTIMONY, CHLORIDE OF.
(Butter of Antimony.)

Solutions of this and of tartar emetic are very differently affected by tests. Nitric acid precipitates the latter, but not the former. Ferrocyanate of potash has no effect on solution of tartar emetic; but it precipitates the chloride of antimony of a yellow-white, or, if much iron be present, Prussian blue is abundantly thrown down.

ARSENIC.

In a *solid* state, white arsenic may be identified by the following properties:—1. A small quantity of the powder placed on platina-foil is entirely volatilized, at a gentle heat, in a white vapour: any residue is impurity. The vapour of white arsenic has no odour. 2. On boiling a small quantity in distilled water, it is not dissolved, but floats in a sort of film, or becomes

aggregated in small lumps at the bottom of the vessel. It requires long boiling, in order that it should be dissolved and equally diffused through water. On adding a few drops of caustic potash to the water, it is entirely dissolved, forming a clear solution of arsenite of potash. 3. When a portion of the powder is mixed with *hydro-sulphuret of ammonia* in a watch-glass, there is no change of colour, as there is with most metallic poisons. On heating the mixture, the white powder dissolves; and on continuing the heat until the ammonia is expelled, a rich yellow or orange film is left (sesquisulphuret of arsenic or orpiment), which is soluble in all alkalies. 4. When a small portion, *i. e.* from one-fourth to one-twentieth part of a grain, is heated with some reducing agent containing carbon, in a glass tube about three inches long and one-eighth of an inch in diameter, it is decomposed; a ring of metallic arsenic, of an iron-grey colour, is sublimed and deposited in a cool part of the tube. At the same time, there is a perceptible odour resembling that of garlic, which is possessed by metallic arsenic in the state of vapour.

Tests for Arsenic in solution.—1. On adding to the solution *ammonio-nitrate of silver*,* a rich yellow precipitate of arsenite of silver falls down—rapidly

* Made by adding, to a very strong solution of nitrate of silver, a weak solution of ammonia; continuing to add the latter until the brown oxide of silver at first thrown down is almost re-dissolved.

changing in colour to a greenish brown. 2. On adding *ammonio-sulphate of copper*,* a rich green precipitate is formed (Scheele's green, or arsenite of copper).

REINSCH'S TEST.—This is a method, lately discovered, of determining the presence of arsenic in liquids, and, from its simplicity and facility of execution, will probably supersede most of the other complex processes of testing for this poison. It is thus performed:—Add to the suspected solution a few drops of *pure hydrochloric acid*, and place in it a slip of *bright copper*. There is no change until the liquid is brought to the boiling point, when, if arsenic be present, even in small quantity, the copper acquires an iron-grey coating, from the deposit of that metal. The slip of copper is to be removed, washed in water, dried, and gradually heated in a reduction-tube, when arsenious acid will be sublimed in minute octohedral crystals: if these should not be apparent from one piece of copper, several may be successively introduced. This test succeeds perfectly with powdered arsenic, the arsenites, arsenic acid, the arseniates and orpiment. It will even separate the arsenic from arsenite of copper and from common lead-shot.

* Made by adding ammonia to a solution of sulphate of copper, until the blueish white precipitate at first produced is nearly re-dissolved: it must not be used too highly concentrated, as it possesses a deep violet-blue colour, which may render obscure the green precipitate formed. The above are called the liquid tests; the first acts with by far the greater delicacy.

All objections to this test are answered on procuring octohedral crystals of arsenious acid from the arsenical deposit, by *slowly* heating the slip of copper in a reduction-tube. If, while heat is applied to the copper in a long piece of tube drawn out at one end, a current of air be gently blown through it, a ring of white arsenious acid will be obtained; this may be filed off, boiled in water, and tested by the ammonio-nitrate of silver and sulphuretted hydrogen.

The above tests being sufficient, it will not be requisite to speak of other well-known tests, as the *sulphuretted hydrogen* test, or that of *Marsh*,—both of which, however, act with great delicacy, and are highly valuable.

COPPER.

The solutions of the salts of copper generally have an acid reaction. *Tests.*—1. Solution of *ammonia;* this gives a blueish white precipitate soluble in excess of the test, forming a deep blue solution. 2. Ferrocyanate of potash, a rich claret-red precipitate. If the quantity of copper be small, the liquid acquires merely a light red-brown colour. 3. *Sulphuretted hydrogen gas*, or *hydro-sulphuret of ammonia*, gives a deep chocolate brown precipitate; or merely a brown colour, if the copper be in small proportion. 4. A slip of *polished iron* (a common needle), suspended by a thread in the liquid, is speedily coated with a layer of copper, even

where the salt is in very small proportion. When much diluted, a drop of dilute sulphuric acid may be added. Of the above tests, the second and third possess the most delicate reaction.

IODINE.

Tests.—1. It destroys vegetable colours like chlorine, but in a much less degree; its smell is also similar to that of chlorine.

2. Its vapour is of a rich violet colour.

3. It unites with starch, forming with it a compound of a deep blue colour. As hot water renders this colourless, it is necessary that the solution be *cold* at the time of adding the starch, and also that iodine itself, and not its compounds, be employed in the experiment.

IODIDE OF POTASSIUM.

(Hydriodate of Potash.)

Add to the clear solution of this salt an equal quantity of a solution of *starch*, and then a few drops of strong *nitric acid*. The blue colour of the iodide of farina produced will show that the salt is an alkaline iodide. This test is extremely delicate. The potash may be detected by decomposing the salt at a high temperature with strong sulphuric acid, when sulphate of potash will result.

LEAD.

1. *Diluted sulphuric acid* produces an abundant white precipitate, soluble in a large excess of caustic potash.

2. *Iodide of potassium*, or *chromate of potash*, produces a yellow precipitate of iodide or chromate of lead.

3. *Hydro-sulphuret of ammonia*, or *sulphuretted hydrogen gas*, produces a deep black precipitate.

4. If a slip of zinc-foil, with a little acetic acid, be introduced into the solution of acetate of lead, a deposit of metallic lead on the surface of the zinc speedily takes place.

MERCURY, BICHLORIDE OF.

(Corrosive Sublimate.)

In the solid state.—1. A small quantity of the powder, dropped into a white saucer containing a solution of *iodide of potassium*, is turned of a bright *scarlet* colour. 2. Dropped into solution of potash, it is turned *yellow*. 3. Into a solution of *hydro-sulphuret of ammonia*, it is turned *black*. 4. When mixed with three or four parts of calcined carbonate of soda, and heated in a reduction-tube, the metal is reduced; and a ring of bright globules of mercury is formed, while *common salt* remains in the tube. This experiment is a conclusive one, as mercury, being the only liquid metal, is the only one which sublimes *in globules*.

Corrosive sublimate in solution in water.—A small quantity of the solution may be first gently evaporated on a slip of glass, and then set aside to crystalize. If it be corrosive sublimate, it forms slender opaque silky prisms, sometimes of considerable length, and intersecting each other. When a solution of iodide of potassium is dropped on them, they acquire a bright scarlet colour, and chloride of potassium is formed. These characters, which may be obtained from one drop of solution, prove that the body dissolved in water is corrosive sublimate, and thus distinguish it from all other substances whatever.

There are several other excellent tests, as the *protochloride of tin* (see page 107), *sulphuretted hydrogen gas*, the *precipitation by metals*, and the *galvanic test*, which need only to be alluded to in this place, the above sufficing for practical purposes.

NITRATE OF POTASH.

(Nitre or Saltpetre.)

May be distinguished,—

1st. By the crystals burning with a crackling noise, and producing a brilliant flame when thrown on red-hot coal.

2. By nitrous acid fumes being produced, on sulphuric acid being mixed with it and heated. (See article *Nitric Acid*, pages 93, 94.)

SILVER, NITRATE OF.

(Lunar Caustic.)

The *solution* in water is commonly acid. 1. A slip of *copper* introduced into a small quantity precipitates metallic silver. 2. *Hydrochloric acid* throws down a white clotted precipitate of chloride of silver (see page 95). 3. *Arsenite of ammonia* gives a yellow precipitate (page 101). 4. *Sulphuretted hydrogen*, a black one. 5. The nitric acid is discovered by adding carbonate of potash, when the filtered liquid will be found to contain nitre.

TIN, CHLORIDE OR PROTOCHLORIDE OF.

This forms a milky solution with water, becoming clear on the addition of *hydrochloric acid*. This acid solution has the following properties:—1. *Chloride of gold* gives a deep purple-brown precipitate, almost black. 2. *Bichloride of mercury*, in small quantity, gives a white, passing to a grey, precipitate of metallic mercury. 3. *Nitrate of silver* gives a white precipitate, insoluble in nitric acid, thus proving the presence of muriatic acid or chlorine.

BICHLORIDE, OR PERMURIATE OF TIN,

Is a highly acid liquid; it is *not precipitated* by chloride of gold or bichloride of mercury. *Sulphuretted hydrogen* gives a yellowish precipitate, which is insoluble in ammonia. *Nitrate of silver* will detect the acid.

(Oxide of; Sulphate of.)

Tests for the solution.—1. *Ammonia* gives a white precipitate, *soluble in excess of the alkali.* 2. *Sesqui-carbonate of ammonia*, the same. 3. *Ferrocyanate of potash*, a white precipitate. 4. *Sulphuretted hydrogen* and *hydro-sulphuret of ammonia*, a white milky precipitate, provided the solution be neutral, or nearly so. If the solution be very acid, sulphuretted hydrogen produces no effect whatever. 5. Sulphuric acid in the solution is detected by the usual test—nitrate of barytes.

FINIS.

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